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# THE UNIVERSITY OF MISSOURI BULLETIN

VOLUME 16 NUMBER 3

EDUCATION SERIES 10

*9 out of 10 print*

CIRCULAR OF INFORMATION  
TO  
ACCREDITED SCHOOLS

ISSUED BY THE COMMITTEE ON ACCREDITED SCHOOLS



SEVENTH EDITION, REVISED

UNIVERSITY OF MISSOURI  
COLUMBIA, MISSOURI  
January, 1915



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## INTRODUCTORY

Organization is the order of the day. In education, as in manufacturing and commerce, it is indispensable to the greatest efficiency. To prevent wasted energy and discouragements which turn many young people from the pathway of their highest development, demands a closer coöperation of the educational forces of the State. This truth is now generally recognized; and, as a result, the efficiency of education in Missouri has been rapidly increasing. County supervision and articulation of elementary and high schools are phases of a general movement which includes also the affiliation of high schools and University, so that there may be a pathway direct from the primary school of any community to the highest educational opportunities offered by the State. For the same reason that high schools must take the initiative in solving the problem of articulating elementary and secondary schools, the University must take the initiative in solving the problem of affiliating high schools and University. Accordingly, in view of a growing demand for organization, the University presents a plan, modified by several years of careful direct study of the school situation, whereby graduates of secondary schools may be admitted to the University without entrance examinations.

This plan necessarily includes a definition of conditions for accrediting. In determining these conditions, it has been the policy of the University to consider in the broadest sense the welfare of high schools. Due recognition has been made of the facts that most graduates of secondary schools do not attend institutions of higher learning, that local conditions vary, and that many schools meet with most discouraging difficulties. It is desirable that high schools have the greatest possible freedom consistent with the purpose of affiliation, and it is the intention of the University to coöperate with them rather than arbitrarily to impose conditions upon them. Accordingly, criticisms of the plan here offered are invited. The administration of this plan requires the examination of each school by an educational expert, whose advice may be taken advantage of by local authorities who wish to improve their schools. This method of affiliation has been justified by the rapid development of many Missouri schools under its influence. As mutual understanding, confidence and coöperation more widely increase, even greater progress is promised for the future.

This circular is prepared for the information of superintendents, principals, teachers and members of school boards who wish to coöperate with the University in this movement. It contains a statement of conditions for the accrediting of secondary schools, outlines of approved subjects, and suggestions for the equipment of laboratories and libraries.

## ADMISSION TO UNIVERSITY FROM ACCREDITED SCHOOLS

Although there is a distinction between conditions for the accrediting of schools and conditions for admission to the University, some brief information with regard to the latter may appropriately be given in this introductory statement.

The University will admit without examination such graduates of an accredited school as offer proper credentials of the fact that they have completed the subjects required for entrance to the college which they desire to enter. For these requirements, see University Catalogue. A certificate of graduation will not be accepted for full value in lieu of entrance examinations, unless the high school course of the pupil has been four years in length and all the work has been done in the regular sessions of the school.

*The diploma will not be accepted as a credential.* The student must present the proper form of certificate, signed by the principal or superintendent of the accredited school. Blank certificates will be furnished by the Dean of the University Faculty. *The University recommends that accredited schools do not issue such certificates to any students except to those who have graduated. Students from accredited schools will not be admitted subject to a condition, unless they are graduates of such schools.*

The certificates should be filled out and sent to the Dean of the University Faculty, Columbia, Missouri. He will then notify the student in due time that his certificate has been approved for entrance, or that certain conditions or corrections are necessary. As the necessity for correction appears in many cases, the student will avoid delay and inconvenience by sending the certificate *as soon as possible* after his graduation. *If a student's certificate is presented later than one week before the opening of the semester, he may be required to take the entrance examinations.* Certificates filed by candidates for admission become the property of the University.

## CURATORS' SCHOLARSHIP

The University offers a scholarship to the student graduating with the highest honors from a fully accredited school. This scholarship entitles the student to admission free of the library, hospital and incidental fee for the first year. The fact that the student is the honor graduate of his class should be indicated on his certificate by the principal or superintendent of the school.

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Copies of the *Circular of Information to Accredited Schools* may be secured through the office of the Secretary of the Committee on Accredited Schools, University of Missouri, Columbia, Missouri.



# CONDITIONS FOR THE ACCREDITING OF SECONDARY SCHOOLS

## METHOD OF ACCREDITING

A school desiring to be placed on the accredited list of the University should present, as early in the school year as possible, an application to be accredited, blank forms of which will be furnished, upon request, by the Secretary of the Committee on Accredited Schools. After the application has been received, the school will be placed on the visiting list and in due time will be inspected by the High School Visitor. No school will be accredited until the report of the Visitor has been passed upon by the University Committee on Accredited Schools.

*The University reserves the right to cease to accredit, at any time, a school that employs inefficient teachers or that otherwise fails to maintain the required standard.*

## MINIMUM REQUIREMENTS FOR FULLY ACCREDITED SCHOOLS

In order to be fully accredited by the University, a school must meet the following *minimum* requirements:

1. The course of study must be four years long; and the school term, nine months.
2. There must be at least three teachers in the school, one of whom may be superintendent, but the other two must give their entire time to high school work.

No teacher should have daily more than the equivalent of six single periods of teaching as hereinafter defined (a less number would be preferable), and, where any teacher has more than this number, the presumption is against the efficiency of the work.

It is strongly recommended that in the selection of teachers, graduates of universities and colleges of recognized standing, or teachers who have had equivalent training, be preferred. With the large increase in teachers having college training, and with the excellent opportunities now offered by the summer schools, the University cannot afford to accredit any school, seeking affiliation, that shows an indifference to the grade of scholarship of the teachers employed.

3. There must be at least one laboratory of science, sufficiently large and well equipped to permit easily of individual work on the part of the pupils.

4. There must be good equipment for the teaching of History and English. This means that the school must have an adequate reference library and a sufficient supply of historical maps.

5. Not less than fifteen units as hereinafter defined must be required for graduation.

Normally no pupil should be permitted to carry more than four subjects at any one time.

6. The school must give satisfactory instruction in subjects as specified below.

By a "unit" is meant a year's work in a subject, with five periods a week. Three periods a week for two years will be accepted as the equivalent of a unit. By a "period" is meant not less than forty minutes of time devoted to actual teaching or eighty minutes devoted to laboratory work.

In the case of the sciences and of Household Arts and Agriculture, at least two of the five periods must consist of eighty minutes each devoted to laboratory work. In the case of Drawing, Manual Training and Bookkeeping, each of the five periods must consist of eighty minutes. In the case of Music, forty minutes count as a half period, so that five forty-minute periods a week for two years is the equivalent of a unit.

The specifications with regard to subjects in which satisfactory instruction must be given are as follows:

English.....	3 units
Mathematics.....	2 units
History.....	2 units
Foreign Language.....	2 units

These two units must be in *one* foreign language, which may be Latin, Greek, French, German, or Spanish.

Science.....	2 units
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The two units in science may be in General Biology, Zoology, Botany, Physiology (provided that the Physiology is preceded by a year's study of Biology), Chemistry, Physics, or Physical Geography; or one unit may be in any one of these sciences and the other in either Agriculture or Household Arts.

Elective Subjects.....4 units

These four units, which are to be given in addition to the ones specified above, must be selected from the subjects named in the following list, in which the maximum and minimum number of units accepted in each are indicated:

Subjects	Maximum	Minimum
English.....	4	3
Algebra (elementary).....	1½	1
Plane Geometry.....	1	1
Solid Geometry.....	½	½
Trigonometry.....	½	½
*Arithmetic (advanced).....	½	½
*Algebra (advanced).....	½	½
History.....	4	2
American Government (Civil Government)...	½	½
Latin.....	4	2
Greek.....	3	2
German.....	3	2
French.....	3	2
Spanish.....	3	2
Physics.....	2	1
Chemistry.....	2	1
General Biology.....	1	1
Botany.....	2	1
Zoology.....	2	1
†Physiology.....	1	1
Physical Geography.....	1	1
Agriculture.....	2	1
Music.....	1	1
Drawing.....	2	1
Manual Training.....	2	1
Household Arts (Domestic Science and Art)...	2	1
Economics.....	½	½
Commercial Geography.....	½	½
Bookkeeping.....	1	½
Teacher-Training Courses.....	(See p. 50)	

\*The courses in advanced Arithmetic and advanced Algebra are not approved, if they are not preceded by those in elementary Algebra and Plane Geometry.

†In cases where the study of Physiology has been preceded by a year's study of Biology.

7. When instruction in subjects named in the list above is given in excess of the minimum requirement, it must, in every case, be efficient.

#### PARTIALLY ACCREDITED SCHOOLS

Secondary schools which maintain a four years' course of study, but do not fulfill all the requirements for a fully accredited school, may be *partially accredited*.

In the case of partially accredited schools, the approved units are specified.

# I

## OUTLINES OF APPROVED SUBJECTS

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### ENGLISH

#### FOUR UNITS MAY BE OFFERED

*Literature.* It is recommended that one-half of the time allotted to English be given to the study of literature, by which is meant not the study of a manual on the history of literature, but literature itself in the selected works of representative authors. Masterpieces as a whole, suited to the attainments of the class, should be read in class and carefully studied, while other works may be assigned as collateral readings, of which reports, written or oral, should be required. In the fourth or last year, in connection with a wider range of reading in literature, a brief history of the literature may conveniently be used.

*English Grammar.* Everywhere pupils enter the high school with an inadequate knowledge of English grammar. The systematic study of grammar, therefore, as the foundation of higher scholarship in English, should be pursued in the high school. An accurate knowledge of grammar and of grammatical analysis is often indispensable to the right interpretation of literature and to confident correctness in composition. Without strict grammatical training the pupil finds himself at a disadvantage in trying to grasp the meaning of an involved sentence as well as in the attempt to express without ambiguity his own thoughts.

The method of teaching grammar should almost invariably be inductive. By making use of the pupil's own words and sentences, his reading, and his composition, one can easily establish the simpler definitions, rules, and principles of grammar. As each point is made, it will be well to refer to a text-book by way of confirmation of what has been found. Following upon this, drill exercises, drawn from the text-book, can be used to advantage. The study of grammar should never become merely formal. All definitions, classifications, and rules should be seen to grow out of, and ever refer back to, words and sentences. The object of the work is not that one may be able to define the parts of speech and state rules, but that he may understand the logic of the sentence. All parsing and analysis should be made a study in relations among words and sentences. No pupil should be graduated who cannot analyze correctly a normal English sentence of moderate complexity.

*Composition and Rhetoric.* Training in the use of the language should be a part of the work in English throughout the course. The English, spoken and written, of the pupils should be watched and corrected not only in their English classes, indeed, but in all their written work. The principles governing punctuation, the use of words, paragraphs, and the different kinds of whole composition, including letter-writing, should be thoroughly mastered. In the English classes, it is advised that set exercises be required every week for the first two years, and, in the third and fourth years, in addition to these exercises, a carefully prepared paper at least once a month; that a due proportion of the class time be devoted to the discussion of these exercises and to explanation of the simpler rules of good writing; and that the exercises be then re-written with correction of errors. The pupil's work in literature, his other studies, and his daily experiences will furnish abundant topics for these exercises. It is most earnestly urged upon teachers that a certain standard of skill in writing be established for each year, and that no pupil be advanced to a higher class in English until he has reached that standard in his written work.

### Readings and Studies in Literature

The list of readings in literature recommended by the National Conference on Uniform Entrance Requirements in English at its last meetings (February 22, 23—May 30, 1912) for the years 1915-1919, and approved by the University, is as follows:

#### FOR READING

The aim of this course is to foster in the student the habit of intelligent reading and to develop a taste for good literature, by giving him a first-hand knowledge of some of its best specimens. He should read the books carefully, but his attention should not be so fixed upon details that he fails to appreciate the main purpose and charm of what he reads.

With a view to large freedom of choice, the books provided for reading are arranged in the following groups, from each of which at least two selections are to be made, except as otherwise provided under Group I.

Group I. Classics in Translation. The *Old Testament*, comprising at least the chief narrative episodes in Genesis, Exodus, Joshua, Judges, Samuel, Kings, and Daniel, together with the books of Ruth and Esther; the *Odyssey*, with the omission, if desired, of Books I, II, III, IV, V, XV, XVI, XVII; the *Iliad*, with the omission, if desired, of Books XI, XIII, XIV, XV, XVII, XXI; Virgil's *Aeneid*. The *Odyssey*, *Iliad*, and *Aeneid* should be read in English translations of recognized literary excellence.

For any selection from this group a selection from any other group may be substituted.

Group II. Shakespeare: *Midsummer-Night's Dream*, *Merchant of Venice*, *As You Like It*, *Twelfth Night*, *The Tempest*, *Roméo and Juliet*, *King John*, *Richard II*, *Richard III*, *Henry V*, and *Coriolanus*; and, if not chosen for study under B, *Julius Cæsar*, *Macbeth*, and *Hamlet*.

Group III. Prose Fiction. Malory: *Morte d' Arthur* (about 100 pages). Bunyan: *Pilgrim's Progress*, Part I. Swift: *Gulliver's Travels* (voyages to Lilliput

and to Brobdingnag.) Defoe: *Robinson Crusoe*, Part I. Goldsmith: *Vicar of Wakefield*. Frances Burney: *Evelina*. Scott's novels: any one. Jane Austen's novels: any one. Maria Edgeworth: *Castle Rackrent*, or *The Absentee*. Dickens' novels: any one. Thackeray's novels: any one. George Eliot's novels: any one. Mrs. Gaskell: *Cranford*. Kingsley: *Westward Ho!* or *Hereward, the Wake*. Reade: *The Cloister and the Hearth*. Blackmore: *Lorna Doone*. Hughes: *Tom Brown's Schooldays*. Stevenson: *Treasure Island*, or *Kidnapped*, or *Master of Ballantrae*. Cooper's novels: any one. Poe: selected tales. Hawthorne: *The House of the Seven Gables*, or *Twice Told Tales*, or *Mosses from an Old Manse*. A collection of short stories by various standard writers.

Group IV. Essays, Biography, etc. Addison and Steele: *The Sir Roger de Coverley Papers*, or selections from the *Tatler* and *Spectator* (about 200 pages). Boswell: selections from the *Life of Johnson* (about 200 pages). Franklin: *Autobiography*. Irving: selections from *The Sketch Book* (about 200 pages), or *Life of Goldsmith*. Southey: *Life of Nelson*. Lamb: selections from the *Essays of Elia* (about 100 pages). Lockhart: selections from the *Life of Scott* (about 200 pages). Thackeray: lectures on Swift, Addison, and Steele in the *English Humorists*. Macaulay: any one of the following essays—*Lord Clive*, *Warren Hastings*, *Milton*, *Addison*, *Goldsmith*, *Frederick the Great*, *Madame d'Arblay*. Trevelyan: selections from the *Life of Macaulay* (about 200 pages). Ruskin: *Sesame and Lilies*, or selections (about 150 pages). Dana: *Two Years before the Mast*. Lincoln: selections, including at least the two Inaugurals, the Speeches in Independence Hall and at Gettysburg, the Last Public Address, the Letter to Horace Greeley; together with a brief memoir or estimate of Lincoln. Parkman: *The Oregon Trail*. Thoreau: *Walden*. Lowell: selected essays (about 150 pages). Holmes: *The Autocrat of the Breakfast Table*. Stevenson: *An Inland Voyage and Travels with a Donkey*. Huxley: *Autobiography* and selections from *Lay Sermons*, including the addresses on *Improving Natural Knowledge*, *A Liberal Education*, and *A Piece of Chalk*. A collection of essays by Bacon, Lamb, De Quincey, Hazlitt, Emerson, and later writers. A collection of letters by various standard writers.

Group V. Poetry. Palgrave's *Golden Treasury* (First Series): Books II and III, with special attention to Dryden, Collins, Gray, Cowper, and Burns. Palgrave's *Golden Treasury* (First Series), Book IV, with special attention to Wordsworth, Keats, and Shelley (if not chosen for study under B). Goldsmith: *The Traveller* and *The Deserted Village*. Pope: *The Rape of the Lock*. A collection of English and Scottish ballads, as, for example, some Robin Hood ballads, *The Battle of Otterburn*, *King Estmere*, *Young Beichan*, *Bewick and Grahame*, *Sir Patrick Spens*, and a selection from later ballads. Coleridge: *The Ancient Mariner*, *Christabel*, and *Kubla Khan*. Byron: *Childe Harold*, Canto III or IV, and *The Prisoner of Chillon*. Scott: *The Lady of the Lake*, or *Marmion*. Macaulay: *Lays of Ancient Rome*, *The Battle of Naseby*, *The Armada*, *Irry*. Tennyson: *The Princess*, or *Gareth and Lynette*, *Lancelot and Elaine*, and *The Passing of Arthur*. Browning: *Cavalier Tunes*, *The Lost Leader*, *How They Brought the Good News from Ghent to Aix*, *Home Thoughts from Abroad*, *Home Thoughts from the Sea*, *An Incident of the French Camp*, *Herre Riel*, *Pheidippides*, *My Last Duchess*, *Up at a Villa—Down in the City*, *The Italian in England*, *The Patriot*, *The Pied Piper*, *De Gustibus—*, *Instans Tyrannus*. Arnold: *Sohrab and Rustum*, and *The Forsaken Merchant*. Selections from American poetry, with special attention to Poe, Lowell, Longfellow, and Whittier.

## FOR STUDY

This part of the requirements is intended as a natural and logical continuation of the student's earlier reading, with greater stress laid upon form and style, the exact meaning of words and phrases, and the understanding of allusions. The books provided for study are arranged in four groups, from each of which one selection is to be made.

Group I. Drama. Shakespeare: *Julius Cæsar*, *Macbeth*, *Hamlet*.

Group II. Poetry. Milton: *L'Allegro, Il Penseroso*, and either *Comus* or *Lycidas*. Tennyson: *The Coming of Arthur*, *The Holy Grail*, and *The Passing of Arthur*. The selections from Wordsworth, Keats, and Shelley in Book IV of Palgrave's *Golden Treasury* (First Series).

Group III. Oratory. Burke: *Speech on Conciliation with America*. Macaulay's *Speech on Copyright* and Lincoln's *Speech at Cooper Union*. Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*.

Group IV. Essays. Carlyle: *Essay on Burns*, with a selection from Burns' poems. Macaulay: *Life of Johnson*. Emerson: *Essay on Manners*.

### The Course of Study

The suggested course outlined below covers four years, and each year is divided into two terms.

It provides for the study of grammar, composition, and literature in suitable proportions. It attempts also to assign to a suitable place in the course most of the items in the Conference list of readings. Titles *starred* are recommended for class room study, the others for outside reading. All the literature in the Conference list may well be read in the course of the four years.

Figures following the different subjects indicate the proportion of the whole English time (five periods a week) of the term to be given to each subject. They do not mean that in each week so much time shall be given to grammar, so much to composition, and so much to literature. On the contrary, it is better, both in grammar and in literature, to work intensively, giving consecutive class periods to one topic until it is mastered and then proceeding similarly with another. Drill in the conventional usages of composition, on the other hand, involving as it does the acquiring of habits, should be kept up steadily, side by side with the other studies. The suggested course is as follows:

#### First Year

*First Half.* (Grammar 2, composition 2, literature 1.)

Grammar.—The parts of speech; subject and predicate.

Composition.—Exercises in capitalization, punctuation, and sentence form. Invention, oral and written, in connection with the literature read. Letter-writing.

Literature.—*The Lady of the Lake*\*; *Treasure Island*; *Arabian Nights*; *Ivanhoe*; *Iliad*; *Tale of Two Cities*; *Last of the Mohicans*; *Old Testament Stories* (Houghton, Mifflin or American Book Co).

*Second Half.* (Grammar 3, composition 1, literature 1.)

Grammar.—Number; case and case relations; transitive and intransitive verbs; complements of the verb; tense; passive voice; compound verb-forms; sentence, clause, and phrase; relatives.

Composition.—Exercises in punctuation and sentence form continued. Paragraph division and paragraph development. Original work in narration and description on subjects suggested by the literature read.



Literature.—*Vision of Sir Launfal*\*; *Snow-Bound*\*; *Odyssey*; *Kidnapped*; *Lamb's Tales from Shakespeare*; *Rip Van Winkle*; *Franklin's Autobiography*; *Quentin Durward*; *Robinson Crusoe*.

### Second Year

*First Half.* (Grammar  $\frac{1}{2}$ , composition 2, literature 2  $\frac{1}{2}$ .)

Grammar.—Classification of sentences (simple, complex, compound; declarative, interrogative, exclamatory.)

Composition.—Exercises in sentence form, punctuation, and vocabulary. Correction of vulgar errors of speech and writing. Unity and coherence of paragraphs. Invention, oral and written, on topics drawn from the pupil's experience.

Literature.—*As You Like It*\*; *Merchant of Venice*\*; *Southey's Life of Nelson*; *Butler's Gordon*, Macmillan; *Kenilworth*; *The House of the Seven Gables*; *The Deserted Village*.

*Second Half.* (Composition 2, literature 3.)

Composition.—Review of punctuation, with special attention to comma, semicolon, full stops, and quotation marks. Constructive exercises in different types of sentence form. Repetitive exercises upon the literature read, to enlarge the vocabulary.

Literature.—*The Ancient Mariner*\*; *The Passing of Arthur*\*; *David Copperfield*; *Lorna Doone*; the *Aeneid*; *A Christmas Carol* and *The Chimes*; *The Cricket on the Hearth*; *Golden Treasury* III and IV\*.

### Third Year

*First Half.* (Composition 2, literature 3.)

Composition.—Exercises in invention, descriptive or narrative. The whole composition; its theme (unity), and its plan (sequence). Outlines drawn up, and developed both orally and in writing, on topics drawn either from reading or from experience. Study of the connotation of words.

Literature.—*Midsummer-Night's Dream*; *Idylls of the King*\*; *Twelfth Night*; *Sketch Book*; *Succession of Forest Trees*\*; *Travels with a Donkey*; *DeCoverley Papers*; *The Tempest*; *The Black Arrow*; *Esther*; *Ruth*.

*Second Half.* (Grammar 1, composition 2, literature 2.)

Grammar.—Mood and the modal auxiliaries; the participle and the infinitive.

Composition.—Exercises in invention, expository and argumentative. The making of outlines by analysis of propositions; topic sentences and their development; transitions; emphasis by arrangement; how to gather material from experience, observation, reading, and reflection; the right

use of reading in original composition; the MS. conventions of citation, quotation, and reference; accuracy of diction.

Literature.—*Pied Piper* and Browning's shorter poems\*; Washington's *Farewell Address*; Webster's *First Bunker Hill Oration*; Parkman's *Oregon Trail*; *Golden Treasury II*\*; Selections from Lincoln; *Dr. Jekyll and Mr. Hyde*; *Genesis*, *Exodus*, *Joshua*, and *Judges*.

#### Fourth Year

*First Half.* (Grammar 1, composition 1, literature 3.)

Grammar.—General review of sentence analysis; idioms and vulgarisms; principles of etymology.

Composition.—Original written work confirming the principles and methods learned in the third year, with special attention to vocabulary and thought development.

Literature.—History of English literature to Milton; *Macbeth*\*; *Henry V*; *L'Allegro*\*; *Il Penseroso*\*; *Lycidas*\*; selections from Wordsworth and Burns; Plato's *Apology*, *Crito*, and *Phaedo*; Paul More's translation, Houghton, Mifflin; *Autocrat of the Breakfast Table*; De Quincey's *Joan of Arc* and *The English Mail Coach*\*.

*Second Half.* (Composition 1, literature 4.)

Composition.—Review of the mechanics of written form and the chief details of good use, with drill as found necessary. Rhetorical types of sentences. Original written work based on study and reflection; oral debate.

Literature.—History of English literature from Milton to the present; *Beowulf* (in translation); *Golden Treasury I*\*; *Julius Caesar*\*; *Henry VIII*; *Colter's Saturday Night*; Carlyle's *Burns*; *Tintern Abbey*\*; *Walden*; Burke's *Speech on Conciliation with the Colonies*\*; *The Scarlet Letter*; *Romola*.

*For library equipment, see pages 78-82.*

### MATHEMATICS

#### FOUR AND ONE-HALF UNITS MAY BE OFFERED

The units which may be offered in mathematics are as follows:

*Algebra. One unit.* Elementary Algebra, including the topics usually presented up to and including the solution of quadratic equations by factoring. The following modifications are recommended, but the omissions from the traditional treatment should not be made without a compensating insertion of work to stimulate actual thinking about the mathematical aspects of concrete things. To assist in this, is the purpose of these suggestions.

The four fundamental operations may be carried out only on arithmetic numbers and on algebraic expressions not longer than trinomials.

Factoring may be limited to forms of the types, the difference of two squares, the square of a sum or of a difference, and monomial factors.

In fractions, the work may be limited to examples, the terms of which are not longer than trinomials, and complicated complex fractions may be omitted; but the interpretations of the rules of Arithmetic in algebraic symbols with a review of arithmetic problems should be included.

Square root may be limited to square roots of arithmetic numbers, monomials, and the squares of binomials, and cube root may be limited to arithmetic numbers and monomials. This should be accompanied by explicit numerical calculations, application to mensuration, and the construction and use of small tables of squares and square roots.

Exponents may be limited to positive integral exponents below 10, but should include such illustrations as arise in the mensuration formulas of Geometry. The actual working of a slide rule without any theory of logarithms may be shown to students in this connection.

Linear and simultaneous linear equations may be limited to two equations in two unknowns, with emphasis on one equation in one unknown. As great a variety of practical problems of the usual types as is possible, and practical problems of Arithmetic by algebraic methods, should be given. For example, the study of isolated numerical problems in percentage can never give the student complete control of percentage, unless that student has unusual powers of generalization. The statement of the general principle underlying percentage is fundamentally algebraic, and this topic should be treated in algebraic formulation as a standard part of the course. This applies not only to percentage, but to every topic in which general formulation of a principle is possible. What is suggested for percentage should be done also for fractions, for proportion, for mensuration rules, etc. The practical problems should include, also, applications of such rules as the rule of the lever, problems on speed, etc.

Quadratic equations may be limited to the solution of numerical examples by factoring; but should include numerous problems stated in English, and such applications as Geometry affords, including the Pythagorean theorem, or those dependent on the falling body formulas.

Graphical processes should begin with graphical representations of quantities by straight lines, circles or other areas, as in representations of statistics, in encyclopedias, geographies, and in many advertisements. They should include, also, the representation of negative quantities, with such illustrations as are afforded by the thermometer, the representation of statistics, and graphs of linear and quadratic equations. With this should be combined the study of variation of quantities, and the dependence of one quantity upon another by any type of formula.

*Algebra. One and one-half Units.* Complete elements of Algebra including the above and also the following: the solution of quadratic equations by completing the square, with emphasis only on those examples where the roots are real; simultaneous quadratics only in a few

simple examples that can readily be illustrated by graphs, with emphasis only on the cases where one equation is linear; the binomial theorem for positive integral exponents, with emphasis only on the cases where the exponent is less than five; ratio and proportion only in the sense of fractional equations, including, however, graphical representations of two variable quantities, one of which is proportional to the other; arithmetic and geometric progression in the usual sense; practical use of logarithms restricted to the base 10, and emphasizing the use of a table, preferably four place\*; fractional and negative exponents with special reference to logarithms, accompanied, if possible, by the practical use of the slide rule; and those practical problems in which quantities raised to fractional powers occur.

*Plane Geometry. One unit.* The work in Plane Geometry, in order to be acceptable, must cover a full year in some good text. Teachers are urged to avoid the error that has crept into our traditional courses in Geometry of emphasising the mere forms of logic at the expense of *geometric thinking*. The main subject-matter of the course should not be the methods by which the conclusions are reached. Proofs should be given, but the proof should not be made the end. Rather, the fundamental aim should be to enable the student to see the geometric truths in any geometric figure quickly and to appreciate their significance.

It is recommended that strong emphasis be placed on a very few of the most important theorems, such as the congruence theorems, the similarity theorems, the Pythagorean theorem, etc., and that the student be led to see that he need not remember many of the lesser theorems, provided he knows how to get them by reference to these larger theorems, whenever he wants them. The student should thus see that the logic of the subject plays a large part in assisting the memory and in relieving the memory from unnecessary burdens. Original demonstrations should form an important part of the work.

It is recommended that informal proofs be accepted for some of the most obvious theorems and that the notion of a strictly logical proof be developed gradually, as the student can be led to see the need for such proof. The theory of limits and the proofs for the incommensurable cases may be omitted or only briefly explained by the teacher.

It is recommended that part of the year be spent on the applications of Algebra to Geometry and of Geometry to Algebra. The connection between Algebra and Geometry now established in the graphical and concrete work in Algebra should not be forgotten. The student's knowledge of Algebra may be kept alive and even slightly extended, and his appreciation of its value greatly strengthened, by frequent incidental use of it throughout the course in Geometry.

It is very desirable that the student should gain in the grades and in connection with the concrete work in Algebra an intimate acquaintance

\*See page 83.

with the objects dealt with in Geometry, and with many of the facts of Geometry, in order that when the regular work in this subject is taken up, it may not be wholly novel to him.

A specially favorable opportunity to make Geometry seem of real value to the student consists in the applications of the theorems on similar triangles to the graphical solution of triangles by drawing them to scale and measuring the unknown parts with ruler and protractor. In this connection, the simplest notions of Trigonometry may be introduced with profit. A small ten cent table of logarithms and trigonometric functions may be obtained\*. Familiarity with such a table will do much to enliven the work and incidentally pave the way for an easier understanding of Trigonometry.

For a detailed discussion of these questions, see the report on Geometry which was presented to the National Educational Association in the summer of 1912. This report was issued in a separate pamphlet accompanying the proceedings of the N. E. A. for 1912; a preliminary report was printed in "School Science and Mathematics," 1911, and the final report was reprinted in "The Mathematics Teacher," Dec., 1912.

*Arithmetic. One-half Unit.* This half unit will not be approved unless it is given after the completion of the elementary courses in Algebra and Geometry. This work in Arithmetic should not be divorced from Algebra and Geometry. Rather the use of principles of Algebra and Geometry should be encouraged, so that the whole point of view in this course can be made more mature and more general than the elementary course in Arithmetic in the graded school. On the other hand, algebraic and geometric work should be done only as it is really valuable. Extended variety of topics is by no means so desirable as a careful study of the meaning of the simpler and more fundamental processes of Arithmetic together with application to problems drawn as widely as possible from Geometry, Physics, mensuration, business and other subjects with which the student is already familiar.

Topics deserving special attention are the following:

The fundamental processes on fractions should be accompanied by a statement of the general principles in algebraic form. Percentage should be clearly shown to be a special case of fractions, and its general principles should be presented in algebraic formulation.

Square root should be accompanied by practical computation emphasizing its applications in mensuration; and the student should be encouraged to use tables of squares, square roots, cubes and cube roots.

Practical problems that involve the use of actual plans of houses and diagrams of machinery, which can be obtained freely from firms of architects and firms of machinery manufacturers, should be used, if possible.

\*See page 83.

Business forms should include forms of checks, notes, drafts, etc. Special attention is called to the value of a study of interest tables, insurance rate books, tables of freight rates, postal rates, etc.

For reference, as a source of material for problems, and on account of useful tables they contain the library should be supplied with at least one standard engineers' handbook\*, and with such a book as the New York World Almanac. Some such material is available also in large encyclopedias.

The high school should own also at least one standard slide rule of not less than 8 inches in length, and a protractor. The laboratory of Physics may supply such instruments as the vernier caliper, whose use should be made clear in this course, even if the student has had no laboratory work.

An effort should be made to explain other mathematical instruments in commercial use, such as water meters, light meters, cyclometers, adding machines; and samples of such devices should be added to the equipment of the school as opportunity affords.

Some advanced text on Arithmetic should be used. A regular eighth grade text is not satisfactory, nor is the average commercial arithmetic suitable for this course.

*Algebra. Additional one-half unit.* This half unit will not be approved unless it is given after the completion of the elementary course in Algebra and Geometry. The course should follow the general spirit of the courses outlined above, but it should cover the more technical phases of Algebra omitted in what precedes. Thus factoring should be extended to such forms as the sum or difference of the  $n$ th powers of two quantities ( $X^n \pm Y^n$ ), the factor theorem and the remainder theorem.

The technique of the four fundamental operations and fractions should be improved by considerable drill work, using polynomials of greater length, and literal co-efficients. The work in linear equations should include three equations in three unknowns; the work in quadratic equations should include the properties of the roots of quadratics and the solution of the simpler cases of simultaneous quadratics.

The work in exponents should cover operations with literal exponents and the theory of logarithms to any base. The course should cover also the solution of equations of higher degree by graphical methods, and the general case of the binomial theorem for positive integral exponents, together with other simple cases of algebraic induction.

Any high school text not intended principally for first year work will include these topics, but scarcely any omission can be made in the usual book, if two units are to be approved.

*Solid Geometry. One-half unit.* The work in Solid Geometry should cover a full half year's work. The logical side of the work may be some-

\*See page 83.

what subordinated, thoroughly emphasizing the question of space intuition and the more important mensuration formulas. The student's space conception may well be aided by the construction and study of models, and by the experimental verification of formulas.

*Trigonometry. One-half unit.* This is supposed to cover a half year's work. The ability to solve a right triangle and any oblique triangle by dividing it into right triangles without using logarithms should be emphasized above everything else. The ability to read tables, to interpolate properly, and the ability to use tables of any kind that may be presented, is very important. The use of logarithms is an essential part of the course, but the logarithmic solutions of triangles may be limited to those cases in which no special formulas are required. Such other topics as the formulas involving two angles, should be treated at least briefly.

*For library equipment, see pages 82-84.*

## HISTORY

### FOUR UNITS MAY BE OFFERED

The course of study should cover from two to four years, each field being studied for a full year, five periods a week of forty minutes each being assigned to the work. The minimum course should cover the origin and development of European civilization in two years of required work, while work of the third and fourth years may be elective and devoted to national histories or to a special study of modern times. Chronological sequence of courses, while desirable from the point of view of historical unity and continuity, is not absolutely essential. The most important aim in high school history should be to develop the pupil's consciousness of past contributions to civilization and of growth or evolution of political, social, and economic character from past to present. With this end in view, purely factual methods of memorizing names, dates, and events should be avoided, and attention paid constantly to the meaning and application of past movements and events to present problems and conditions, but it must not be forgotten that these names, dates, and events form the framework of history without which no real historical knowledge can be acquired. In this way alone can history be made a profitable high school study and the large amount of time given to it in the present day curriculum be justified.

Either of the following groups of courses will be acceptable as a four-year curriculum, although the first is for the present recommended as more standard and easier to arrange: (1) The traditional four-year course, consisting of Ancient History—the Orient, Greece, Rome, and the beginning of the Middle Ages to 800 A.D.; Mediaeval and Modern History; English History; American History. (2) A new four-year course,

consisting of Ancient History (same as above); English and European History to 1760; Modern European History, including England, since 1760; American History.

Should American Government be studied as a part of the four years' work, a half-year may be given to it, or the American History may be given for three periods through the year and the American Government for two periods, thus making a separation on a fairly equitable basis. In either case the emphasis should be laid on United States development rather than on American colonial history.

In making a three-year curriculum it is advisable to choose from the following groups: (1) Traditional three-year course, consisting of Ancient History to 800 A.D.; Mediaeval and Modern History, or English History; American History and Government. English and American History may alternate as third year electives if Mediaeval and Modern History is regularly required. (2) A new three-year course, consisting of European development from earliest times to the 18th century, the history of England and America being included; Modern European History; United States History since 1763. The latter course has not been fully developed and should not be attempted except with teachers prepared for it and satisfactory text-books.

The best two-year curriculum is probably one that covers the general development of European civilization in broad courses on Ancient History and Mediaeval and Modern History. However, it would be possible to substitute courses in European development from earliest times to the 18th century, the history of England and America being included, and United States History since 1763, as indicated in the statement of a new three-year course, and so cover both the European background and the history of the United States. A two-year course is not recommended and accredited schools offering but two units should make every effort to add another year's work in history to their programme, or, better still, two years additional.

The following brief statements with regard to the several units will serve to indicate the scope of the course and the type of text-books that should be used.

*Ancient History. One unit.* The completion of a careful and thorough course of study extending over one entire school year in ancient Oriental, Greek, and Roman history. The list following will indicate the type of books that should be used as the basis for this course: Botsford, *History of the Ancient World*, Macmillan; Goodspeed, *History of the Ancient World*, Scribner; Morey, *Outline of Ancient History*, American Book Co.; Myers, *Ancient History*, Rev. Ed., Ginn; West, *The Ancient World*, Allyn and Bacon; Webster, *Ancient History*, Heath; Westermann, *Story of the Ancient Nations*, Appleton; Wolfson, *Essentials in Ancient History*, American Book Co.



*Mediaeval and Modern History. One unit.* A year's study of the history of the European nations and their development and institutions from the period of the Germanic invasions to the close of the nineteenth century. The course should be based on a standard high school text such as: Adams, *Mediaeval and Modern History*, Macmillan; Bourne, *Mediaeval and Modern History*, Longmans, Green; Davis, *Mediaeval and Modern Europe*, Houghton, Mifflin; Harding, *Essentials in Mediaeval and Modern History*, American Book Co.; Munro and Whitcomb, *Mediaeval and Modern History*, Appleton; Myers, *Mediaeval and Modern History*, Rev. Ed., Ginn; Robinson, *History of Western Europe*, Ginn; Thatcher and Schwill, *General History of Europe, 350-1900 A. D.*, Scribner; West, *Modern History*, Allyn and Bacon.

*European History. Two units.* In place of the one unit courses in Ancient History and Mediaeval and Modern History outlined above, schools may give courses in European Development based on such texts as Robinson and Breasted, *Outlines of European History, Part I*, and Robinson and Beard, *Outlines of European History, Part II*, Ginn.

*English History. One unit.* A thorough study of English political, governmental, economic and social history extending through one full school year and based on any standard text-book such as: Andrews, *History of England*, Allyn and Bacon; Cheyney, *Short History of England*, Ginn; Coman and Kendall, *History of England*, Macmillan; Larned, *History of England*, Houghton, Mifflin; Terry, *History of England for Schools*, Scott, Foresman (Chicago); Thomas, *History of England*, Heath; Tout, *Advanced History of England*, Longmans, Green; Walker, *Essentials in English History*, American Book Co.; Wrong, *History of the British Nation*, Appleton.

A half unit in English History will be given for a shorter course of study based on less advanced texts such as Higginson and Channing's *History of England*; Ransome's *Short History of England*, and Montgomery's *English History*. The half-unit course is not recommended, however, and the half-unit course should be given only when it is impossible to devote a full year to the subject.

*American History. One unit.* This course should embrace a year of advanced work in American political, social and institutional history with special reference to the period since 1763. The following text-books suggest a standard for this course: Adams and Trent, *History of the United States*, Allyn and Bacon; Ashley, *American History*, Macmillan; Channing, *Student's History of the United States*, Macmillan; Hart, *Essentials of American History*, American Book Co.; James and Sanford, *History of the United States*, Scribner; Larned, *History of the United States*, Houghton, Mifflin; McLaughlin and Van Tyne, *History of the United States*, Appleton; Montgomery, *Student's American History*, (Rev. Ed.)

Ginn; Muzzey, *American History*, Ginn; Woodburn and Moran, *American History and Government*, Longmans, Green.

A half-unit in American History will be given for a briefer, or half-year, course of an advanced character but less comprehensive in scope. Such a course is not recommended, however, save in connection with the half-unit in American Government.

*For list of maps and library equipment, see pages 84-94.*

## AMERICAN GOVERNMENT (CIVIL GOVERNMENT)

### ONE-HALF UNIT MAY BE OFFERED

*Course of Study.* Systematic instruction in American Government should be postponed to the last year of the course of the secondary school. There is a distinct advantage in this plan. If given in the earlier years the work would be largely a review of what had been done in the last year of the elementary school. Still more important is the consideration that the senior in the secondary school is a much better subject for such instruction than are pupils in the first and second years. He will be much more appreciative of the spirit and content of the course.

American Government should be given as a distinct course and not as a part of the work in American History. History, however, is so essential to good results in the teaching of government that credit will not be given for work in American Government unless it is preceded by at least one-half year's work in American History. The best plan is to offer American Government in the second half of the senior year following American History in the first half of such year. It is recommended, moreover, that during the earlier years of the course much incidental instruction in American Government should accompany the work in History and Geography. Emphasis should be placed upon the historical development of political institutions in order that the pupil may be brought to a true understanding of what may otherwise appear arbitrary and irrational.

*Methods of Instruction.* The course should begin with a study of local government. The pupil can be made to understand local institutions much more readily than those of the state or nation since the former come within the range of his personal experience. In his daily life he is brought into contact with organs and activities of local government and these should be seized upon by the teacher as object lessons to illustrate the work of the course. The city will furnish the best and most numerous illustrations of this character. It will be relatively an easy matter to excite the curiosity and arouse the interest of the pupil in governmental organs which he can see and whose activities are brought home to him. In this way he will receive a real training in citizenship. From the

institutions of the city it will be possible to proceed in like manner to those of the county, state and nation.

The pupil's interest in the work can be retained and heightened by visits to places which have to do with governmental activities. The city hall, public water and lighting plants, the public library, postoffice, the school itself,—all will furnish excellent means for illustrating the work in American Government. The pupil should be encouraged to study the government of his city and make reports upon various phases of its organization and work, *e.g.*, the mayor, city clerk, street improvement, lighting, etc. The work in American Government may also be supplemented by having the school debating societies discuss questions of civic interest.

A good text-book is desirable. In many cases its arrangement may not correspond to the plan above, but it will be possible to take up the parts of the text in a different order from that in which they are presented. The text-book must be largely supplemented by the teacher and by collateral reading and reference work. A small reference library is essential.

*For library equipment, see pages 94-96.*

## LATIN

### FOUR UNITS MAY BE OFFERED

The student should acquire such a vocabulary and such a knowledge of inflections and syntax as to read readily simple Latin prose with accurate quantitative pronunciation of the words. He should be carefully trained in reading Latin aloud, with proper emphasis and expression, and in rendering Latin into choice, idiomatic English. In addition to the reading, there should be considerable practice throughout the four years in writing Latin and in making accurate written translations. There should be some sight reading each week.

The *first year* should be spent in thoroughly mastering the elements of the language as given by such beginners' books as D'Ooge's, Hale's, Bennett's, Collar and Daniell's, or Pearson's.

During the *second year*, four books of Cæsar's *Gullic War* should be read. An equivalent of Nepos, Viri Romae, or Eutropius may be substituted for one book of Cæsar, if the pupils need some simple Latin as a bridge. This is not recommended, however, unless it is absolutely necessary. An equivalent amount of Cæsar's *Civil War* may be read instead of the *Gullic War*. This is recommended especially in the case of classes in which a large number are going over the year's work a second time. The reading should be accompanied by a careful and systematic review of grammatical forms and by a study of the leading principles

of syntax, with Byrne's *Syntax of High School Latin* as a guide. These principles should be impressed upon the pupil's mind by the translation into Latin of English sentences based upon the text read. One exercise a week should be given entirely to this composition work, in which the marking of all long vowels should be insisted on.

During the *third year* the following orations of Cicero are usually read: four orations against Catiline, the oration for the Manilian Law, the oration for the Poet Archias. Instead of these, an equivalent may be read in Sallust's *Catiline*. The grammar and composition work of the preceding year should be continued.

It is recommended that the *fourth year* be begun by the reading of about a thousand lines of Ovid's *Metamorphoses*. This is to be followed by four or five books of Vergil's *Aeneid*, including the Sixth Book. If only four are read, about eight hundred lines from the *Eclogues* or *Georgics* should be read. If desired, the whole year may be devoted to reading six books of the *Aeneid*. The technique of the Latin hexameter should be taught, and its rhythm should be felt as quantitative and not merely translated into an accentual rhythm.

In connection with the reading of Latin, the mythology of the Greeks and Romans and the life and history of the Roman People should be thoroughly taught. The military, constitutional and private customs of the ancients should be carefully worked out by the teacher, who is thus enabled to illumine countless passages for the student. Map drawing by the student serves to impress upon his mind the geography of the ancient world.

*For library equipment, see pages 97-103.*

## GREEK

### THREE UNITS MAY BE OFFERED

The *first unit*, consisting of introductory lessons, should include (1) Xenophon's *Anabasis* (20 to 30 pages), (2) practice in reading at sight and in writing Greek, and (3) the beginning of systematic study of grammar.

The *second unit* should include (1) continuation of Xenophon's *Anabasis*, either alone or with other Attic prose (75 to 100 pages); (2) practice in reading at sight, systematic study of grammar, thorough grammatical review and practice in writing Greek, both based on study of Books I and II of the *Anabasis*.

The *third unit* should include (1) Attic prose: e.g., Lysias' *Orationes*, or Plato's *Apology* and *Crito*, or Xenophon's *Memorabilia*, with

practice in writing Greek, in grammar, and in reading at sight; (2) Homer (2500 to 4000 lines); e.g., *Odyssey* Books I-V, or *Iliad* Books I-III (omitting ii, 499-end), and VI-VIII.

Useful text-books for the above work are:

1. For the *first year's* work.—Ball's *Elements of Greek*, Macmillan; White's *First Greek Book*, Ginn; Gleason and Atherton's *First Greek Book*, American Book Co.; Gleason's *Gate to the Anabasis*, Ginn.

2. For the *second year's* work.—Mather and Hewitt's *Xenophon's Anabasis*, American Book Co.; Smith & Bonner, *Xenophon's Anabasis*, D. Appleton; Goodwin and White's *Xenophon's Anabasis*, Ginn; Goodwin's *Greek Grammar*, Ginn; Hadley-Allen, *Greek Grammar*, American Book Co.; Pearson's *Greek Prose Composition*, American Book Co.

3. For the *third year's* work.—Morgan's *Eight Orationes of Lysias*, Ginn; Wait's *Ten Select Orationes of Lysias*, American Book Co.; Bristot's *Ten Selected Orationes of Lysias*, Allyn and Bacon; Adams' *Selected Speeches of Lysias*, American Book Co.; Flagg's *Apology and Crito of Plato*, American Book Co.; Smith's *Xenophon's Memorabilia*, Ginn.

For library equipment, see pages 97-103.

## GERMAN

### THREE UNITS MAY BE OFFERED

The *first unit* should comprise: (1) Careful drill upon pronunciation. (2) Systematic drill upon the elements of grammar, including the inflection of the articles, the noun, the adjectives, the pronoun, the verb, strong and weak; also upon the use of the common prepositions, the simpler use of the modal auxiliaries and elementary rules of syntax and word-order. (3) Abundant practice (a) in oral and written reproduction of the text, (b) in the memorizing of colloquial and idiomatic phrases, and (c) in dictation.

All reading in this course should be intensive. The pupil should be required to give back the entire subject-matter in German, either in the form of German answers to German questions, repetitions from memory, or free oral or written reproduction. The teacher may use discretion as to the number of pages thus treated. Ordinarily a class cannot treat more than 100 pages in this manner with sufficient thoroughness.

The *second unit* calls for about 200 pages of moderately difficult reading, chiefly prose, with constant practice in oral and written reproduction of selected portions; also drill upon the more difficult chapters of grammar such as the passive voice, use of cases with prepositions, verbs, adjectives, uses of tenses and modes (especially the infinitive and subjunctive), likewise upon word-order, and word-formation. Thoroughness rather than quantity should be insisted upon. About 100 pages

should be treated intensively in the class room, as indicated in the case of the first unit. The remainder should be assigned for study outside the class. Written reports on this outside reading should be required of the students.

The *third unit* should continue the grammatical drill of the previous units. The intensive treatment of texts in the class and the extensive outside reading should be continued, and the number of pages assigned for both purposes should be increased. The students should acquire the ability to use the German language effectively as a means of oral and written expression, and should be given abundant practice in the writing of compositions. In the selection of texts three types should be represented: narrative, dramatic, and historical and descriptive.

Books adapted to the work of each of the three units are included in the list of library equipment.

*For library equipment, see pages 103-109.*

## FRENCH

### THREE UNITS MAY BE OFFERED

In general throughout the course the teacher should aim at quality rather than quantity.

*First unit.* The work of the first year should aim to give the student: (1) an accurate pronunciation; (2) a knowledge of the rudiments of the grammar; (3) the ability to translate simple sentences into French and to express in idiomatic French simple ideas; (4) the ability to understand simple ideas expressed orally in French; (5) a vocabulary and knowledge of construction sufficient to enable him to read ordinary French with considerable ease.

The drill in pronunciation should begin with the first meeting of the class and should continue unremittingly until the last. It is not only an end in itself, but it makes for accuracy in the knowledge of grammatical forms and is a great aid in the retention of vocabulary. As a part of such drill frequent dictations are indispensable.

The grammatical work should include the regular and the more common irregular verbs, the inflection of nouns, adjectives, participles, and pronouns, the use of pronouns, adverbs, prepositions, and conjunctions, sentence-order, and the elements of syntax. The amount studied should be about that covered in Thieme and Effinger's *Grammar*, the first part of Fraser and Squair's *Grammar*, Aldrich and Foster's *Elementary French*, or Chardenal's *First French Course*.

A minimum of about 150 pages should be read. There are a number of readers which present a sufficient variety of graded material and some of the easier of the texts mentioned below as suitable for the second

year could be used profitably. There should be constant practice in translating into French easy variations of the texts read, and this, in conjunction with the English sentences given in the grammar, will insure an abundance of drill in this respect.

*Second unit.* The work of the second year should include the reading of a minimum of 350 pages of modern prose, including a number of short dramatic works, with constant practice as before in retranslation of variants of the texts read. The drill in pronunciation and the writing of French from dictation should be continued. The grammar work should include a careful review of the ground covered in the first year, with drill upon all irregular verbs that are not very rare, the uses of the subjunctive, and a more detailed study of the syntax. There should be constant practice in the construction of sentences. Students should be required to give either orally or in writing abstracts of portions of the texts read. Any of the following texts, recommended by the Committee of Twelve of the Modern Language Association of America, are suitable for the second year: About's *Le Roi des Montagnes*; Bruno's *Le Tour de la France*; Daudet's easier short tales; La Bédollière's *La Mère Michel et Son Chat*; Erckmann-Chatrian's stories; Foa's *Contes Biographiques* and *La Petit Robinson de Paris*; Foncin's *Le Pays de France*; Labiche and Martin's *La Poudre aux Yeux* and *Le Voyage de M. Perrichon*; Legouvé and Labiche's *La Cigale chez les Fourmis*; Malot's *Sans Famille*; Mairét's *La Tâche du petit Pierre*; Mérimée's *Colomba*; extracts from Michelet; Sarcéy's *Le Siège de Paris*; Verne's stories.

*Third unit.* The work of the third year should include the reading of from 600 to 1000 pages of French, with constant practice in paraphrasing and abstracting portions of the texts in French. The drill in pronunciation and in the writing of French from dictation should be continued unremittingly. A good grammar should be studied carefully. Students should be drilled in writing simple original themes in French. The texts recommended by the Committee of Twelve are as follows: About's stories; Augier and Sandeau's *Le Gendre de M. Poirier*; Béranger's poems; Corneille's *Le Cid* and *Horace*; Coppée's poems; Daudet's *La Belle-Nivernaise*; La Brète's *Mon Oncle et Mon Curé*; Madame de Sévigné's letters; Hugo's *Hernani* and *La Chute*; Labiche's plays; Loti's *Pêcheur d'Islande*; Mignet's historical writings; Molière's *L'Avare* and *Le Bourgeois Gentilhomme*; Racine's *Athalie*, *Andromaque* and *Esther*; George Sand's plays and stories; Sandeau's *Mademoiselle de la Seiglière*; Scribe's plays; Thierry's *Récits des Temps Mérovingiens*; Thiers's *L'Expédition de Bonaparte en Egypte*, Vigny's *Canne de Jonc*; Voltaire's historical writings. It is recommended, however, that only sparing use be made of the classical plays, especially those of Corneille and Racine, which are more suitable for a fourth year.

*For library equipment, see pages 109-110.*

## SPANISH

## THREE UNITS MAY BE OFFERED

The work in Spanish should aim at a combination of the practical and the esthetic. Emphasis throughout the course should be laid on beauty of expression, the characteristic tone of Spanish literature, historical and literary references, on the one hand, and a sure grasp of grammatical principles, thorough drill in verbs, and independent expression, both oral and written, on the other.

*First unit.* The instruction should above all be practical. Drill in variety should be the method, and thoroughness, the object. Students, on finishing this course, should be able to read easy texts like Hill's *Spanish Tales for Beginners*, Holt; Valera's *El Pájaro Verde*, Ginn; and Carrión and Vital Aza's *Zaragüeta*, Silver, Burdett. About 150 pages of connected prose should be read. Exercises in the memorizing of vocabulary should be given frequently. A small portion of each period should be devoted to pronunciation and dictation. The conversational method should be employed as soon as possible and gradually enlarged in its application. For this purpose, a rather limited every-day vocabulary dealing with objects of common use, and Spanish and Latin-American life and customs should be compiled and put into practice, preferably in the form of short, rapid questions and answers. Nutt's *English-Spanish Conversation Dictionary*, Ritter and Flebbe, Boston, will be found helpful. Grammars recommended are Wagner's, Third Edition, Ann Arbor Press; Olmsted and Gordon's, Holt; Hills and Ford's, Heath. In composition work, any ten sentences illustrating each lesson should be sufficient.

*Second unit.* A rapid review of the grammar, along with the writing of all composition work, should be made. The class-room work should be carried on as largely as possible in Spanish. The reading of about 350 pages of modern prose is required, such as that of Galdós' *Mariandela*, Heath; Valera's *El Comendador Mendoza*, American Book Co.; Moratín's *El Sí de las Niñas*, American Book Co. Some attention should be paid to literary qualities. Crawford's *Spanish Composition*, Holt, or an equivalent, should be used both for composition and conversation. The *Boletín de la Unión Panamericana* (Washington, D. C.) will prove of interest and value to students.

*Third unit.* Some of the more difficult masterpieces should be taken up, and considerable time devoted to their value as literature. Pupils should be referred to good histories of Spanish literature such as Fitzmaurice-Kelly's or Ticknor's. Three or four works should be read of the caliber and length of Galdós' *Doña Perfecta*, Heath; Núñez de Arce's *El Ház de Leña*, Heath; Ford's *Selections from Don Quijote*, Heath; and Calderón's *La Vida es Sueño*, American Book Co. Umphrey's *Spanish Prose Composition*, American Book Co., is suitably graded for this year.



The ability to converse should be developed. For grammatical reference the following are suggested: Ramsey's unabridged *Text-book of Modern Spanish*, Holt; Bello y Cuervo, *Gramática de la Lengua Castellana*, A. Rogers, Paris.

*For library equipment, see pages 110-111.*

## PHYSICS

### TWO UNITS MAY BE OFFERED

The work of the *first unit* consists of three closely related parts; namely, class work, lecture-demonstration work, and laboratory work.

The class work includes the study of at least one standard text. It should aim to build up in the pupil's mind clear concepts of physical terms and quantities, and an intuitive appreciation of the general principles which make up the syllabus given below. The pupil should be trained in the use of those principles in the solution of simple, practical, concrete numerical problems.

In the laboratory, the pupil should perform at least thirty individual experiments, and should keep a careful note book record of them. At least twenty of these should involve numerical work and the determination of such quantitative relations as may be expressed in whole numbers. Such quantitative work should aim to foster the habit of thinking quantitatively, but should not attempt to verify laws with minute accuracy nor to determine known physical constants with elaborate apparatus. The list of topics covered by these quantitative experiments ought not to differ widely from the list of starred topics in the syllabus.

The teacher is not expected to follow the order of topics in the syllabus unless he wishes to do so. The list is not intended to include all the material for the year's work. It is purposely made short, in order that each teacher may be free to supplement it in a way that fits his individual environment. It does include those topics which all agree are essential to a first course in Physics, and which are capable of comprehension by boys and girls of high school age.

Syllabus of topics.—\*(1) Weight, center of gravity. \*(2) Density. \*(3) Parallelogram of forces. (4) Atmospheric pressure; barometer. \*(5) Boyle's law. (6) Pressure due to gravity in liquids with a free surface; varying depth, density, and shape of vessel. \*(7) Buoyancy; Archimedes' principle. \*(8) Pascal's law; hydraulic press. (9) Work as force times distance, and its measurement in foot-pounds and gram-centimeters. (10) Energy measured by work. \*(11) Law of machines: work obtained not greater than work put in; efficiency. \*(12) Inclined plane. \*(13) Pulleys, wheel and axle. \*(14) Measurement of moments by the product of force times arm; levers. (15) Thermometers: Fahrenheit and Centigrade scales. (16) Heat quantity and its measurement in gram calories.

\*(17) Specific heat. \*(18) Evaporation; heat of vaporization of water. \*(19) Dew point; clouds and rain. \*(20) Fusion and solidification; heat of fusion. (21) Heat transference by conduction and convection. (22) Heat transference by radiation. (23) Qualitative description of the transfer of energy by waves. (24) Wave length and period of waves. (25) Sound originates at a vibrating body and is transmitted by waves in air. \*(26) Pitch and period of sound. \*(27) Relation between the wave length of a tone and the length of a string or organ pipe. \*(28) Resonance. (29) Beats. (30) Rectilinear propagation of light; pin-hole camera. \*(31) Reflection and its laws; image in a plane mirror. \*(32) Refraction, and its uses in lenses; the eye, the camera. \*(33) Prisms and dispersion. (34) Velocity of light. (35) Magnetic attractions and repulsions. \*(36) Field of force about a magnet. (37) The earth a magnet; compass. (38) Electricity by friction. (39) Conductors and insulators. \*(40) Simple galvanic cell. \*(41) Electrolysis; definition of the ampere. \*(42) Heating effects; resistance; definition of the ohm. \*(43) Ohm's law; definition of the volt. \*(44) Magnetic field about a current; electromagnets. \*(45) Electromagnetic induction. \*(46) Simple alternating current dynamo of one loop. \*(47) Electromagnetic induction by breaking a circuit; primary and secondary. (48) Conservation of energy.

The notebook should be a concise record of what the pupil has done. The data should be so tabulated that any one familiar with the subject, or the pupil himself some months later, will be able to understand just what was done. It should be neat, clear and accurate, but the notebook is not the object of the course and too much time should not be put on it.

The text-book should be equal in grade to one of the following: Adams, American Book Co.; Black and Davis, Macmillan; Carhart and Chute, Allyn and Bacon; Coleman, Heath; Hoadley, American Book Co.; Mann and Twiss, Scott, Foresman; Millikan and Gale, Ginn; Mumper, American Book Co.

For the laboratory it is advisable to use a laboratory manual separate from the text-book. There are now a number of excellent manuals published. The use of one of these will in general be much more satisfactory than notes which must be copied by the pupils. The following manuals are suggested: Adams, American Book Co.; Crew and Tatnall, Macmillan; Coleman, American Book Co.; Hoadley, American Book Co.; Nichols, Smith and Turton, Ginn; Millikan and Gale, Ginn; Reeve, American Book Co.; Twiss, Scott, Foresman.

A *second unit* may be given, consisting of a continuation of the laboratory work for another year, or a year's work in a more advanced text together with laboratory work.

*For laboratory equipment, see pages 52-56.*

*For library equipment, see pages 111-112.*

## CHEMISTRY

## TWO UNITS MAY BE OFFERED

The *first unit* should consist of a year's work as outlined in a standard text-book of high school grade. It should consist of two closely related parts; namely, recitations including demonstrations by the teacher, and laboratory work.

Each pupil should be provided with an outfit of apparatus for the laboratory exercises, which should be largely carried out by the pupils working independently. A limited number of experiments, however, may be conducted by two pupils working together. Each pupil should record in a note book what he observes, and should do so at the time the observations are made. The interpretation of observed results and calculations may be recorded in the note book later, if the teacher so prefers.

As Chemistry is an art as well as a science, stress should be laid on handling and setting up apparatus in a neat and orderly manner. In the use of reagents, thought should be given to proportions, and the wasting of materials should be prevented. In experimentation, careful planning and skill of the hand should be emphasized. In this way the laboratory work becomes an interacting process of thinking, doing, and thinking. The pupils, for example, should know why an apparatus should be air tight and how to make it air tight; why gases are washed and dried, and how this operation must be done.

The text and reference books, as a rule, furnish an adequate and systematic account of the chemical changes selected for study, but the equally important feature of the course, the art of Chemistry, is imparted directly by the teacher.

In both laboratory and class work, the materials chosen for study should be restricted to a relatively small number of elements and their chief compounds. Interest in the work may be increased by applications of the facts and generalizations of the text to familiar phenomena in daily life. Visits should be made to the gas works, ice plant, lime kiln, and other chemical industries in the locality. The more important discoveries of Chemistry should become associated with the great masters of the science by anecdote, personal characteristics, or contemporary events.

A *second unit* may be given, consisting of more advanced work in the subject, during the same length of time as required for the first unit.

*For laboratory equipment, see pages 57-60.*

*For library equipment, see pages 112-113.*

## GENERAL BIOLOGY

## ONE UNIT MAY BE OFFERED

This course should be designed to present a general survey of biological science, including the life processes, the activities, the adaptations, as well as the structure of organisms, treated from the standpoint of their general relations. General Biology is the study of the fundamental properties of living things, as illustrated by a carefully selected series of both animal and plant forms.

The laboratory work guided by suitable directions, should precede text-book work on any subject, and the pupil should be required to make careful drawings and notes on all observations. Accurate observations and records of the normal activities of living animals and plants should be made whenever practicable, both in the laboratory and in the field. Simple experiments upon the behavior of animals are very valuable, and should be made if possible.

The following series of forms for study is suggested. (1) amœba; (2) paramoecium or vorticella; (3) haematococcus; (4) yeast plant; (5) spirogyra; (6) hydra; (7) mucor or penicillium; (8) earthworm; (9) crayfish; (10) grasshopper; (11) fern; (12) fresh water mussel; (13) seeds and seedlings; (14) flowering plant; (15) frog, with metamorphosis. The *Elements of Biology* by Hunter or *The Essentials of Biology* by the same author are good texts for this work.

*For laboratory equipment, see pages 60-62.*

*For library equipment, see pages 113-118.*

## BOTANY

## TWO UNITS MAY BE OFFERED

The work of the *first unit* should deal, for the most part, with the seed plants, and should consist of recitations, laboratory work and field studies. While the study of structure is essential, yet most emphasis should be placed on the activities of plants. The studies with lower plants should deal almost entirely with gross structures, life habits and economic importance.

The following topics are suggested:

**General Studies with Seed Plants.**—(1) The parts of a mature plant—roots, stem, leaves, flower. (2) The functions of roots and their modifications. (3) The functions of stems and their modifications. (4) Buds. (5) Leaves and their work. (6) Flowers, parts, functions, adaptations for pollination. (7) Fruits, kinds, adaptations for dispersal, value to man. (8) Seeds, structure, germination, etc. (9) Relation of plants to light, soil, water, atmosphere. (10) Plant families, studies of common repre-

sentatives of the important plant families, as the roses, legumes, grasses, lilies, composites, etc. Forests and forest trees may well be considered here.

Studies with Lower Plants.—(1) Algae, general appearance, abundance, local distribution, and relation to water supplies. (2) Bacteria, relation to decay, to soils, to disease in plants and animals, to purity of milk and water supplies, to public hygiene. (3) Molds, appearance, occurrence, importance in relation to food products. (4) Yeasts and fermentation. (5) Rusts, smuts, etc., as the cause of plant diseases, parasitic method of living, control of plant diseases. (6) Mushrooms, edible and poisonous, cultivation, agents in destruction of timber. (7) Liverwort, habits, distribution and life cycle. (8) Moss, habits, distribution and life cycle. (9) Fern, life cycle, distribution, local types.

Careful drawings, notes, and deductions should be made. The student should make his own studies first and then read his text.

This outline is not intended as an essential arrangement, for the latter is best determined by convenience. Any arrangement, however, should enlist the interest of the pupil in the living plant—the plant in action—and laboratory studies should be made to bear this out. It is better, also, to omit some of the topics suggested than to treat them inadequately. The teacher must determine the apportionment of time, and bring out the connection of the topics.

The *second unit* should cover essentially the same ground as is taken up in Coulter's *Plant Structures*, or Bergen and Davis' *Principles of Botany*, Part II, dealing with the morphology, evolution and classification of plants. A careful laboratory study of types of the great groups of plants should be made. The forms selected should be considered largely from the standpoint of evolution.

*For laboratory equipment, see pages 60-62.*

*For library equipment, see pages 113-118.*

## ZOOLOGY

### TWO UNITS MAY BE OFFERED

The study of each form should include a consideration of the following: (1) habitat; (2) geographical distribution; (3) food; (4) adaptations to environment, including relations to other forms of animal and plant life; (5) general activities; (6) economic relations; (7) life history, and (8) structure.

In Zoology the same methods of instruction should be followed as are outlined above under General Biology.

For the *first unit*, the following series of forms for study is suggested: (1) Protozoa (amoeba, and paramoecium or vorticella). (2) A coelen-

terate, (hydra). (3) An echinoderm (starfish or sea-urchin). (4) An annelid worm (earthworm). (5) A parasitic worm (cestode or trematode). (6) A decapod crustacean (crayfish). (7) An orthopterous insect (grasshopper, and comparison with other orthoptera). (8) A coleopterous insect. (9) A lepidopterous insect, with *larva and pupa*. (10) A hymenopterous insect. (11) A pelecypod mollusc (fresh water mussel). (12) An amphibian (frog, with metamorphosis). (13) A fish, turtle, bird and mammal, briefly and for comparison with the frog.

For high schools equipped to do thoroughly satisfactory work with older pupils, Linville and Kelly's *A Text-book in General Zoology* is recommended. With younger pupils or limited equipment, Jordan and Kellogg's *Animal Life* is suggested.

A *second unit* may be given, consisting of more advanced work in the subject, with a study of additional forms, during the same length of time as required for the first unit.

*For laboratory equipment, see pages 60-62.*

*For library equipment, see pages 113-118.*

## PHYSIOLOGY

### ONE UNIT MAY BE OFFERED

It is recommended that Physiology be preceded by a course in General Biology, or by a course either in Zoology or in Botany. At least two double periods a week should be given to laboratory demonstrations by the instructor and to dissections and physiological experiments performed by the student, always under careful supervision. In the high school Physiology course, a certain amount of time should be given to the anatomical study of structures which are to be used later for physiological experiment and demonstration; but the structures should be studied primarily for the sake of a better understanding of the functions. Careful notes and drawings of the structures dissected should be preserved for use as guides later in making physiological preparations. The laboratory experiments performed on the living organs and tissues should include tests to show the characteristics of muscular contraction, nerve irritability, blood pressure, the heart beat, the pulse, the capillary circulation, etc. Note books should be kept in connection with all physiological demonstrations. The notes should indicate the specific observations with regard to the living organs, and should show the results obtained from the study of mechanical records of such phenomena as occur too rapidly for direct observation, for example, the pulse wave. It is recommended that the elementary phases of physiological chemistry be presented in the subject of digestion, secretion, blood clotting, and the composition of one or two tissues. The original laboratory notes taken at the time of the experiment should be preserved.

The text-books and printed guides are numerous and a judicious amount of selection and elimination is necessary. Of the better high school texts may be mentioned, Martin's *Human Body*, revised edition; Hough and Sedgwick's, *The Human Mechanism*; Huxley's *Lessons in Elementary Physiology*, revised edition; Hewe's *High School Physiology*, which has directions and suggestions for laboratory experiments; Walter's *Physiology and Hygiene*.

*For laboratory equipment, see pages 62-64.*

*For library equipment, see pages 118-119.*

## PHYSICAL GEOGRAPHY

### ONE UNIT CREDIT

The following outline includes only the more essential topics for a unit course. The order of topics should be arranged to suit individual schools.

Introductory Study of the Earth.—(1) The earth in the solar system; origin of earth. (2) Structure of earth: mantle rock; bed rock; the "crust"; the centrosphere. (3) Incessant changes in surface; the warfare of forces. (4) Geologic time. (5) Minerals and rocks; interrelation of igneous, sedimentary, and metamorphic rocks.

Physiographic Processes.—(1) Changing the surface—the building-up forces and processes: rising and sinking of land; folding and faulting, mountain-building forces; vulcanism, earthquakes, hot springs, geysers. (2) Changing the surface—the tearing-down forces and processes: work of atmosphere, weathering, wind abrasion; work of underground water; work of surface water; work of ice; work of waves; other degrading processes. (3) The physiographic cycle: young, mature and old rivers; interruptions in the cycle.

The Ocean.—(1) The basins. (2) Floors of basins. (3) Tides. (4) Surface currents. (5) Life.

Mathematical Geography.—(1) Meridians; parallels; latitude and longitude; zenith; nadir; horizon; altitude; map projections. (2) Revolution and rotation of the earth. (3) Apparent motion of sun; location of tropics; date of equinoxes and solstices. (4) Inclination of earth's axis; position of earth at equinoxes and solstices; length of daylight at various latitudes at solstices and equinoxes. (5) Determination of latitude from altitude of sun or pole star. (6) Determination of longitude.

The Atmosphere.—(1) General conceptions. (2) Climatic factors. (3) Source of heat; heating of ground; of water; of air. (4) Insolation and radiation during day; temperature curve for average day. (5) Distribution of solar heat over earth; temperature curves for year at various latitudes. (6) Sea level isotherms of world. (7) Distribution of surface temperatures of world. (8) Pressure. (9) Winds: origin; relation to pres-

sure; terrestrial winds; shifting of wind belts. (10) Rainfall: causes; distribution. (11) Weather: cyclones; anticyclones; weather forecasting. (Students should begin making weather observations in early autumn. Instruments are not needed. A record should be made of changes in temperature, direction of wind, quality of air, rain, snow, cloudiness or clearness. The relation of local conditions to general conditions of the weather as shown on the weather map should be noticed.) (12) Types of climate: windward, leeward, interior climates of cold temperate; windward, leeward, interior climates of intermediate zone; windward, leeward, interior climates of sub-tropical zone; trade winds wet of tropical zone; trade winds dry of tropical zone; monsoon of tropical zone; equatorial.

Physiographic Features.—Physiography of the United States may be studied by provinces or as physiographic types including plains, plateaus, mountains, rivers, lakes, coast lines, etc. The study of the physiography of the United States may be introduced by a short discussion of the paleogeography of North America. More time should be devoted to a study of physiographic features than to physiographic types. The teacher should emphasize the influence of climate and the various topographic forms on life, and more especially on human life.

*For laboratory equipment, see pages 64-66.*

*For library equipment, see pages 120-121.*

## AGRICULTURE

### TWO UNITS MAY BE OFFERED

The work should consist of two parts, (1) individual laboratory and field work, and (2) recitations based upon the laboratory work, the textbook and assigned readings. Three periods a week should be given to the recitation and not less than two eighty-minute periods a week to laboratory and field work. As a rule, the laboratory and field work should precede rather than follow the recitation. Every school should have a small plat of ground, an acre or more, for a school farm and garden. It is not essential that the topics be studied in the order given below or in the order given in any textbook. A seasonal arrangement is strongly recommended. The work in animal husbandry should include a careful study of the principal types and breeds of the more common farm animals. Emphasis should be placed upon the study of horses, cattle, swine and poultry. There should be practice in stock judging, with the use of the score cards.

No special list of experiments is required. Each teacher should secure from the standard laboratory manuals a list of at least sixty experiments. These experiments are to be in addition to any experiments or demonstrations given by the teacher. Practically every topic in the



outline given below may be made the basis of a profitable laboratory or field exercise. The outline is as follows:

Farm and Garden Crops.—(1) Plant propagation: seeds, buds. (2) Cereal crops: corn; wheat; oats; rye; barley. (3) The legumes: the clovers; cowpeas; soy beans; alfalfa; vetch. (4) Grass crops: timothy; blue grass; red top; orchard grass; millet. (5) Orchard crops: apples; peaches; pears; plums; cherries; nuts. (6) Small fruits: strawberries; grapes; blackberries; raspberries; currants; gooseberries. (7) Kitchen garden crops: potatoes; tomatoes; melons; cabbage; cucumbers; radishes; lettuce; beans; peas; onions. (8) Fibrous and miscellaneous crops: cotton; flax; hemp; broom corn; castor beans; sorghum. (9) The wood lot; timber crop. (10) Insect enemies of farm crops.

Soils.—(1) Origin and formation. (2) Composition and classification. (3) Soil water. (4) Soil air. (5) Soil temperature. (6) Soil drainage. (7) Soil organisms. (8) Meaning and method of testing the soil.

Animal Husbandry.—(1) The horse: origin and brief history; the two principal types, including the speed type and the draft type; breeds, including draft breeds (Percheron, Clydesdale and English Shire), roadsters (American trotter, American saddle horse, English thoroughbred, Hackney, French coach); care of horses. (2) Cattle: origin and brief history; the two principal types (dairy cattle, beef cattle); breeds, including beef breeds (Shorthorn, Hereford, Polled Hereford, Aberdeen Angus, Polled Durham, Galloway), dairy cattle (Holstein, Friesian, Jersey, Guernsey, Ayrshire, Dutch Belted, Brown Swiss), dual purpose breeds (Shorthorn, Devon, Red Polled); cattle products, including meat, milk, leather, glue, etc. (3) Sheep: the two types, including wool-producing and mutton producing; principal breeds, including wool-producing, (American Merino, Delaine, Rambouillet), mutton producing (Shropshire, Southdown, Cotswold); care of sheep. (4) Swine: the principal breeds, including Poland China, Berkshire, Duroc-Jersey, Chester White, Hampshire, Tamsworth, Large Yorkshire; care of swine; diseases of swine and how to control or prevent them, especially cholera and tuberculosis. (5) Poultry. (6) Chickens: the four principal types, including meat type, egg type, general purpose type, ornamental type; breeds, including meat type or Asiatic class (Brahma, Cochin, Langshan); egg types or Mediterranean class (Leghorns, Minorcas, Black Spanish); general purpose or American type (Plymouth Rock, Wyandotte, Rhode Island Red); care of poultry, including feeding chickens, the incubator, the chicken house; poultry and poultry products, importance, value and use.

Farm Management.—(1) Choice of farm. (2) Farm sanitation. (3) Farm buildings. (4) Farm machinery. (5) Maintenance of soil fertility. (6) Improvement of farm animals. (7) Farm records and accounts. (8) Feeds and feeding. (9) Miscellaneous problems.

Ornamental Gardening.—(1) Location of building and farm structures. (2) The lawn. (3) Roads, walks and drives. (4) Arrangement of trees, shrubs and flowers. (5) Planting and care.

See also 1913 supplement to the State Course of Study, issued by State Department of Education.

If a *second unit* is given, the work should be more advanced, and the teacher should have adequate special preparation in Agriculture.

*For laboratory equipment, see pages 67-68.*

*For library equipment, see pages 121-122.*

## MUSIC

### ONE UNIT MAY BE OFFERED

In the unit's work in Music, the pupils should acquire the ability to do the following:

1. To sing a selection (unaccompanied) in the key and time in which it is written, after having had the pitch "C" given to them. Either the "movable do" or "fixed do" methods may be used or better still the syllable "la" as disassociated from either. In the matter of difficulty the selection should be on a par with songs found in books suitable for High School Choral practice, such as Hoff's *Corona Song Book*, Ripley and Tapper's *Advanced Music Reader* (The Natural Course), Smith's *Fourth Book* (The Modern Music Series), Tomlin's *Laurel Song Book*.

2. To name and qualify (perfect, major, minor, augmented, diminished) intervals struck on the piano, both in succession and combination, by other persons. The pupils should not see the keys as they are struck, but should recognize the intervals by ear. The tests as given under 1 and 2 are for the purpose of a clear recognition of tones and their symbols.

3. To write the chords to figured basses, implying a knowledge of the primary and secondary triads in major and minor and their inversions and of the chord of the dominant seventh with its inversions and resolutions. This work is covered in the first 77 pages of Jadassohn's *A Manual of Harmony*.

If the pupils have not had music in the grades, proficiency in sight reading may be acquired by the use of such books as *The Modern Music Series* (Primer, First Book, Second Book, Third Book), Silver, Burdett; *Educational Music Course* (First Reader, Second and Third Readers; Fourth and Fifth Readers), Ginn; and *Natural Music Course* (Primer, First Reader, Second Reader, Third Reader), American Book Co.

For continuing Music in the High Schools, such books as the following will be found serviceable: *The Laurel Song Book*, Boston, C. C. Birchard; *The Corona Song Book*, Ginn; *Songs of the Nation*, Silver, Burdett; *Standard Songs and Choruses*, American Book Co.; *The Modern Music Series*—Fourth Book, Silver, Burdett; *Art Songs for High Schools*, American Book Co.

While sight-reading necessarily implies ear-training, special attention may be given to the latter subject by the use of such a book as Heacox's *Ear-Training*, (Philadelphia), Presser.

It is suggested that the work in harmony be based on such a book as Jadassohn's *A Manual of Harmony*, New York, Schirmer.

## DRAWING

### TWO UNITS MAY BE OFFERED

The outline below, adopted by the North Central Association of Colleges and Secondary Schools, indicates the nature of the work which should be included in the two units of Drawing. While the work is not separated here into a *first* and *second* year program, the more elementary forms of each phase of the subject should be selected for the *first* year. Approximately one-third the time should be given to representative drawing and two-thirds to decorative composition, constructive and decorative design, construction and applied design.

The outline is as follows:

Pictorial.—Plant study (flowers, sprays of leaves, seed pods, etc.). Object study. Landscape (roof studies, buildings, etc.). Pose drawing. Composition.

Decorative Composition.—Plant forms, object study, landscape, pose.

Decorative Design.—Plant analysis (for the purpose of design). Conventionalized plant forms. Decorative units, borders, surfaces, corners, rosettes, posters, book-covers, etc. Stencils, wood-block printing. Historic ornament. Arrangement of straight lines, and of straight and curved lines. Geometric design. Lettering, illuminating. Schemes for interior decoration.

Constructive Design.—Designs for pottery, leather, metal, book-binding, furniture, cardboard construction, textiles, etc.

Crafts.—Pottery, leather work, metal work, book-binding, furniture. (Choice of one or more of the above crafts.)

Applied Design.—Design applied to the crafts and to cardboard, textiles, etc.

Illustration.

Talks on history and industry of art, on civic planning, domestic architecture and decoration.

Instrumental drawing to be given as needed to meet the requirements of practical designing and construction.

*Note.*—Mediums used: pencil, charcoal, water colors, crayons, brush and India ink, and a combination of the pure mediums.

It is desirable to accentuate the life interest in these subjects as well as the technical achievement. Taught from the standpoint of their social interest, these topics may be made of great benefit in the adjustment of the student to social life. For example, in constructive design

the problem of the house could be studied from the view-points of convenience, suitability, cost, appearance, etc. Under decorative design, schemes for the interior decoration of one or more rooms in the individual pupil's house (as planned above) could be worked out. This idea might be extended to embrace business houses, factories, etc. The pictorial composition could deal largely with the industrial occupations of man, with sketch and pose work made tributary to this end. Complete expression is to be sought; and, whenever possible, the problem should be approached from the side of its relation to the life of the pupils.

*For library equipment, see pages 122-124.*

## MANUAL TRAINING

### TWO UNITS MAY BE OFFERED

Manual Training finds a place in schools because it provides the "industrial experience," a fundamental experience not obtainable through other school subjects. To have the greatest educational value, the specific experience of the shop and drafting room should be generalized in the mind of the student. This means that to the "making of something," the art, there must be added an understanding of the fundamental principles, the science, underlying the processes outlined in the syllabi, and the student should be brought to see the significance of his specific shop experiences in their relation to other life experiences.

The formation of a habit of knowing the name of every tool and the names of their principal parts, the habit of carrying on necessary conversation in proper technical terms, the knowledge that underlying every process of every trade are reasons based upon hundreds of years of "race experience" that can be resolved into scientific statements which the student should know—these things, as well as to the manipulation of material, are essential factors in the industrial experience.

The work should consist of (1) recitation upon assigned reading closely related to the work under way in shop or drafting room; (2) lecture-demonstration of new work about to be executed; (3) shop or drafting work. The recitation should not exceed ten or fifteen minutes. The lecture-demonstration, if properly planned, need not exceed twenty minutes.

The use of a text is recommended as the most efficient way of placing before the students material for study. Such a text should deal with principles in general rather than in connection with some specific project, and the assignments should be made from day to day according to the subject-matter under consideration in the shop rather than by page sequence.

From one-third to one-half of the time allotted to a unit should be devoted to mechanical drawing.

For pedagogic reasons, woodwork and mechanical drawing should both, in the main, make use of the "useful model." To cover the principles outlined for the first unit in one year, the useful model must give way to a maximum emphasis upon the "exercise." Where suitable equipment, time, and teaching staff are available, the more elementary subject-matter in both mechanical drawing and woodwork should be given in the upper grammar grades. For this elementary-school work, not less than  $2\frac{1}{2}$  hours per week for two years or 5 hours per week for one year should be given; the equipment should be not unlike that used in the high school; the teacher should be as well prepared for this special work as is the high school teacher. Under such conditions the high school may more nearly meet proper high school standards in this work.

The subject-matter should be so planned that new matter may be introduced gradually. Instruction should be by class rather than individual. The use of the "group system" is strongly recommended as the most efficient way of providing class instruction with due consideration of individual differences on the part of pupils. For an illustration of such grouping of subject-matter, consult *The Teaching of Manual Arts* by Crawshaw and Selvidge, Bulletin No. 546, High School Series, price 10 cents, University of Wisconsin, Madison, Wisconsin.

*First Unit.* The outline of work for the first unit is as follows:

Mechanical Drawing.—The problems of the drafting room should be made to connect as closely as possible with those of the shop. The introduction of mechanical drawing subject-matter in an orderly manner should not be sacrificed to meet such correlation, however. By proper selection and arrangement, working drawings may be made the means of introducing many, if not all of the conventions enumerated below.

The following should be considered: (1) Freehand lettering: placing; form; slant; spacing; stroke. (2) Working drawings: woodwork; stock bills, material costs figured; freehand working sketches. (3) Straight lines: use of T-square, triangles, pencil, ruling pen, dividers, scale; conventional lines. (4) Circles: use of compasses; center lines; cross hatching. (5) Tangents: location of centers and points of tangency. (6) Planes of projection: elementary principles of projection. (7) Revolution of objects: "views" of objects in simple and inclined positions.

Woodworking.—The following should be considered: (1) Laying-out tools: rule; try-square; framing square; bevel; marking gage; slitting gage; mortise gage; dividers; pencil; knife. (2) Saws: crosscut or handsaw; rip-saw; compass saw; back saw; turning saw; filing of saws. (3) Planes: kinds of planes; setting and adjusting irons; squaring up mill-planed stock; squaring up rough stock; face marks; planing a chamfer. (4) Boring tools: brace; auger bit; drill bit; gimlet bit; countersink bit; screwdriver bit; bradawl; through boring; boring to depth. (5) Chisels: kinds of chisels; horizontal, vertical and oblique paring; paring chamfers; the former gouge; grinding beveled edge tools; whetting beveled edge tools;

oilstones; shapes of cutting edges of various plane irons; testing for sharpness. (6) Form work and modeling: making a cylinder; making curved edges; modeling. (7) Duplicate part work: laying out duplicate parts; scraping; sandpapering; hammers; nails; nailing; nailset; withdrawing nails; screwdriver; screws; fastening with screws; designation of nails and screws; glue; clamps; gluing and clamping. (8) Joinery: the dado; crosslap; glue joint; doweling; keyed mortise-and-tenon; blind mortise-and-tenon; miter joint; dovetail joint. (9) Wood: structure; growth; respiration and transpiration; moisture; shrinkage; weight; grain. (10) Lumbering and milling: lumbering; milling; quarter sawing; waste; transportation; seasoning; lumber terms and measurements. (11) Common woods: classification and properties of cedar, cypress, pine, spruce, ash, basswood, birch, butternut, cherry, chestnut, elm, gum, hickory, maple, red and white oak, sycamore, tulip or yellow poplar, walnut, mahogany. (12) Wood finishing: kinds of finishes; application of filler, stains, wax, copal varnish, shellac; patching; painting; rubbed finishes.

*Second unit.* The outline of work for the second unit is as follows:

Mechanical Drawing.—(1) Mechanical lettering: placing; form; slant; spacing; stroke. (2) Working drawings: metalwork. (3) Developments: prism; cylinder; pyramid; cone. (4) Intersections: axes in the same plane; axes in different planes. (5) Isometric and cabinet drawing.

Woodworking.—Elementary cabinet work: Use of combination plane; drawer construction; rabbeted and blind dovetail joints; paneling; haunched mortise-and-tenon; rabbeting; fitting and hinging and locking a door; furniture construction; simple machines.

*For laboratory equipment, see pages 68-71.*

*For library equipment, see page 124.*

## HOUSEHOLD ARTS (DOMESTIC SCIENCE AND ART)

### TWO UNITS MAY BE OFFERED

One unit may be offered composed of the most important portions of the two units outlined below, or each of the two units mentioned below may be offered individually. If two units are offered, it seems better to have during each year some work in both cooking and sewing rather than to have all the cooking one year and all the sewing another.

*A Unit in Cooking.* A unit in cooking should be based on the principles underlying the selection and preparation of food. It should contain such material as is necessary in order to give the pupils the information which is needed to prepare foods in the simplest and most economical manner, to select food wisely, and to plan and prepare simple meals. Naturally this will involve a study of the method of cleaning and caring for the kitchen and the utensils which are necessary there, and an elementary form of dietetics.

The following outline is suggested:

Preservation of Food.—(1) Causes of spoiling: action of bacteria; action of enzymes. (2) Methods of preventing spoiling: refrigeration; drying; household preservation; commercial preservatives; heat. (3) Canning fruits and vegetables: heating to boiling, including advantages of cooking in cans over the old open kettle method; heating at temperature above boiling, water seal canner, steam pressure canner; fractional heating. (4) Making preserves: with addition of equal amounts of or three-fourths as much sugar; elimination of some of the water in the fruit so as to have the sugar solution sufficiently concentrated to keep the mass, through soaking the vegetables in sugar (osmosis), draining and concentrating the juice, and cooking fruit in it for only a fraction of the time; and through cooking juice and fruit together until desired consistency is secured. (5) Making marmalade and jam. (6) Making jelly: need of acid and pectin in juice; amount of sugar; time of cooking; temperature. (7) Making pickle: elimination of excess water in pickle, by soaking in brine (osmosis) and by pressure (mechanical means); getting the flavor and preserving material into the particles of vegetable. (8) Estimation of value of preserved fruit and vegetable in diet compared with cost of commercial articles.

Sugar.—(1) Making candy: brittle candy, through action of dry heat on sugar, formation of barley sugar and caramel; cream candy, effect of action of moist heat and acid on cane sugar, effect of invert sugar in retarding crystallization of cane sugar solution; taffy and caramels, action of invert sugar or glucose in completely inhibiting crystallization of cane sugar; divinity and marshmallows, effect of egg white, gelatin and gum on the texture; place of sugar and candy in the diet, estimation of cost; classification of sugars. (2) Classify sugars and sirups.

Cooking and Composition of Fruits.—(1) Reasons for cooking fruit. (2) Effect of cooking cellulose in sugar solutions. (3) Cooking dried fruits, including a study of the absorption of water and softening. (4) Place of fruit in the diet.

Starch.—(1) Making starch pudding from the different starches: effect of moist heat in gelatinizing starch; forming a mold sufficiently stiff to hold shape through use of two table-spoonfuls of corn starch; forming, through use of rice, wheat, and arrow root starch molds less stiff than those made by use of corn starch; necessity of boiling in order to make starch mixtures sufficiently stiff, to correct the raw starch flavor, and probably also to render it more digestible. (2) Making cream toast: making starch more digestible through transforming it into dextrin by use of heat; making cream sauce of butter, flour, and milk. (3) Cream soups: components, including water in which vegetable has been cooked, milk, flour, and butter; varying consistency of cream soups depending upon the part they are to play in the meal.

Vegetables.—(1) Cooking potatoes: hydrolyzing starch and softening cellulose; preserving flavor by baking or boiling in jackets. (2) Cooking cabbage, onions, carrots, and peas. (3) Special ways of preparing vege-

tables. (4) Composition of vegetables and their value in the diet: appreciable amounts of energy furnished in the form of carbohydrate and fat; value as sources of mineral matter; value in furnishing ballast to the intestine.

Review.—Classification of carbohydrates; the place of vegetable foods in the diet.

Eggs.—(1) Soft and hard cooking of eggs. (2) Poached and shirred eggs. (3) Omelettes and souffles: leavening of mixtures by incorporation of air; slow cooking to allow expansion of air before the cells set and to prevent the over-cooking of the egg. (4) Sponge cakes: typical sponge cake; angel cake; sunshine cake. (5) Custard: (6) Cheapening of egg mixtures: substitution of starch when egg used as means of leavening a mixture; substitution of some other liquid and baking powder up to the limit of one-half the egg when egg is used as a means of leavening a mixture. (7) Summary: composition of egg mixtures and a discussion of the effect of preparation on digestibility.

Milk.—(1) Measuring amount of cream, estimating fat by Babcock test; making cottage cheese from the skim milk; relating above facts to composition of milk. (2) Making cup of cocoa, working out the reasons for the formation of scum on milk. (3) General composition of milk and its value and use in the diet. (4) Essential points in infant feeding.

Milk Products.—(1) Cheese: rarebit, including study of means of thickening, custard and white sauce basis, and effect of over-cooking; general composition, digestibility, place in the diet, and effect of preparation on digestibility; preparation of some typical cheese dishes. (2) Butter: appearance of fat under microscope in cream and whole milk: estimation of fat by Babcock test; churning, including comparison of composition of butter, cream and buttermilk; manufacture of oleomargarine and its value in the diet. (3) Cream: composition, cost, and marketing; homogenizing of cream; ice creams, including study of use of fillers, necessary constituents, use of binders, use of ice and salt in freezing; place of frozen creams in the diet.

Fats.—(1) Study of composition of fats, their digestion and place in the diet. (2) Use in cooking. (3) Frying potato chips, including a study of use of fat as a means of cooking, the danger of decomposition, and formation of acrolein.

Salads.—(1) Constituents differentiating light and heavy. (2) Making dressing, cooked, mayonaise, French. (3) Combination in typical salads. (4) Place of salads in the diet.

Meat.—(1) Preparation of beef juice. (2) Study of cuts of meat. (3) Roasting and broiling, to develop and keep flavor. (4) Pot roast, Swiss steak, and stews, to keep flavor and at same time make the meat tender. (5) Making of soups: extracting flavor and dissolving gelatin; food value of soups and beef extracts. (6) Comparison of cost and nutritive value of different cuts of meat. (7) Effects of cooking on digestibility of meat.



Gelatin Desserts.—(1) Methods of preparing. (2) Place in the diet.  
Review of Protein Food.—(1) Principles of cooking. (2) Classification.

Batters and Doughs.—Popovers, batter cakes, and muffins, including a study of constituents and proportions of butter, and use of steam and baking powder as rising agents. (2) Cakes: relation of cake to muffins; possible limits in proportions. (3) Biscuit, shortcake and pastry, including a study of proportions for soft and stiff doughs, effect on texture of increasing the amount of fat; folding in fat as a means of leavening. (4) Cookies: relation to cake.

Study of Baking Powders.—Kinds, including a study of amount of gas liberated in hot and cold, amount and character of residue, harmfulness of residue.

Food per Day.—(1) Amount and kinds necessary. (2) Terms in which measured. (3) Factors which affect amount.

*A Unit in Sewing.* A unit in sewing should be composed of the subject-matter necessary to give students the knowledge necessary for the selection and construction of clothing. A certain amount of practice work must be given in both hand and machine sewing in order to enable the student to construct the garments required. So far as is possible, this practice should be applied in concrete problems and not in the form of small samples for which the student can not see any real need. The material desirable in the construction of the various problems should be studied carefully, in order to enable the students to use materials wisely and intelligently. The economic side should be stressed wherever possible. The cost of the garments should be calculated, taking into account the amount of time required in making them. The cost and quality of the home-made garments should be compared with that of the ready-made. In this way the students will be given standards of judgment and trained to select more wisely the ready-made garments which form so large a part of the wardrobe of most of them at the present time.

This will, of course, involve a study of the necessary equipment for sewing and the proper furnishing of that portion of the home in which the sewing is done, in order that it may be done more efficiently. The following is a very brief outline suggesting the problems which may be considered in such a course. These problems should be varied to meet the need of the individual community.

The following outline is suggested:

Planning, Selection of Material, and Construction of Garments.—Each topic under this heading should have the following sub-topics: study of purpose, selection of design adapted to purpose, selection of material adapted to purpose, construction, calculation of cost, scoring and comparison of quality and price with those of the ready-made garment.

(1) Apron. (2) Gown. (3) Drawers. (4) Corset cover. (5) Underskirt. (6) Simple dress.

Repair of Garments.—(1) Daily care; putting away; brushing and pressing. (2) Repair, taught as far as possible by means of problems the girls bring from home and, incidentally, motivated by grading pupils lower for loose buttons and lack of fastenings on their clothing: sewing on fastenings; darning stockings, gloves, wool and damask; patching, hemmed, overhanded, flannel.

Cleaning of Clothing.—(1) Laundry work. (2) Dry Cleaning.

*For laboratory equipment, see pages 72-74.*

*For library equipment, see pages 125-128.*

## ECONOMICS

### ONE-HALF UNIT MAY BE OFFERED

The course in Economics should not be given earlier than the fourth year in the high school. The subject-matter should include the leading facts and principles of economics, such as division of labor, the factors of production, the laws of diminishing returns, demand and supply, value and price, wages, interest, rent and profit, credit, taxation, regulation of monopolies, and international trade. One of the better grade of texts in current use such as those by Bullock, Clark, Davenport, Ely and Wicker, Johnson, Laughlin, Walker, etc., will serve as a basis for the work, but should be supplemented with discussion and practical exercises.

*For library equipment, see page 128.*

## COMMERCIAL GEOGRAPHY

### ONE-HALF UNIT MAY BE OFFERED

Commercial Geography is the science dealing with the geographic influences affecting the exchange of commercial products. While processes of production and human influences will necessarily enter into the study in a general way, the emphasis should be put on physiographic and climatic conditions influencing commerce. The aim should be (1) to give the pupils an insight into the principles of the geography of commerce; (2) to give them an interest in the current problems of international commerce; (3) to show the pupils where statistical data on various commercial topics may be found; (4) to teach the pupils how to present this data graphically. Commercial Geography should be preceded by Physical Geography, if possible.

The course should include the following topics:

General Geographic Influences.—(1) Origin and brief history of commerce. (2) Complementary commercial regions due to differences in stage of development, climatic differences, unequal distribution of mineral resources, the great trade routes of the world. (3) The climatic zones and conditions in each affecting indigenous plant life, animal life, agricultural products, industrial activities and development. (4) The distribution of population of the world: distribution as affected by relief and climate; relation of density of population to occupations; relation of density to industrial development; relation of density to purchasing power. (5) Development of transportation: relative cost of various modes; factors affecting use of various modes in different parts of the world. (6) Ship canals of world. (7) Types of harbors: requisites of a good harbor; harbor improvement. (8) Factors affecting location and growth of commercial centers. (9) Human influences affecting commerce: influences of race, language, religion; influence of customs and habits; government aid to commerce; government participation; tariffs; international exchange.

Regional Studies.—Each of the great trading countries should be studied as follows: (1) The rank of the country among the commercial nations; the kind of exports and imports. (2) The location with respect to the great trade routes and other commercial nations. (3) The physical features. (4) The climate and climatic provinces. (5) Plant life, indigenous and cultivated. (6) The density of population and capacity for population. (7) The stage in industrial and social development. (8) The purchasing power of the people. (9) Mineral resources; power resources. (10) Internal transportation. (11) Harbor facilities. (12) The past, present and future status of the country in commerce.

The United States should be treated in detail, the other countries according to their importance in the commerce of the world. For a half year course, most of the time devoted to regional studies should be put on the study of the United States.

The text book should be supplemented by (1) a study of coast charts of the coasts and harbors of the United States and of maps of the harbors of the great parts of the world; (2) a study of topographic and relief maps showing the relation of topography to lines of transportation; (3) problems in the graphic presentation of data; and (4) the reading of current articles and books dealing with commercial topics. Much valuable material suitable for class discussions may be obtained from a *good* daily newspaper. There should be frequent discussions of the relative future importance of the various countries in commerce.

The rank of Missouri among the states in the various mineral and agricultural products should be considered. A study of the industries of Missouri with reasons for their localization would be valuable. The conservation of the natural resources of the United States and the states should also receive some consideration.

## BOOKKEEPING

## ONE UNIT MAY BE OFFERED

Bookkeeping should be done largely under the eye of the teacher as laboratory work. Good penmanship, neatness in work, accuracy and speed must all be acquired in such laboratory practice. The exercises in some of the texts which are offered by the various publishers on first lessons or elementary principles would naturally form the basis for much of such work, unless the teacher prepares his own exercise work according to a similar plan. The best evidence of good work in this subject is the character of exercise work which the student can present as a result of his laboratory practice.

The work of *one unit* in bookkeeping is the equivalent of that normally done in five eighty-minute periods a week for the school year. The student should become familiar with the meaning of double entry terms, with rules for debit and credit, and the kinds and uses of books required in accounting. He should acquire the ability to keep a single entry and a double entry set of books. Furthermore, he should become familiar with such standard business forms as bills, receipts, checks, notes, time and sight drafts, endorsements, invoices, accounts, sales, deposit tickets, express receipts, bills of lading, statements of account, balance sheets, etc. He should become familiar also with the forms of business letters, beginnings and endings, etc., and should know how to write and answer telegrams and advertisements.

A *half-unit* in bookkeeping may be offered, the work to consist of that normally done in the equivalent of five eighty-minute periods a week for one-half of the school year.

Some of the best reference works, useful especially to the teacher in charge of elementary work, are Sprague's *Philosophy of Accounts*, Hatfield's *Modern Accounting*, Lisle's *Accounting in Theory and Practice*, Dicksee's *Bookkeeping for Accounting Students*, and Cole's *Accounts—Their Construction and Interpretation*.

## TEACHER-TRAINING COURSES

For description of the teacher-training courses, see syllabus issued by State Superintendent of Public Schools, Jefferson City, Missouri.

(For the satisfactory completion of the courses outlined in this syllabus, two units may be counted toward admission to the University.)

*For library equipment, see page 129.*

## II

# SUGGESTIONS FOR THE EQUIPMENT OF LABORATORIES

### GENERAL INFORMATION

The laboratories of a high school should be on the north side of the building, and the length of the room from east to west should be made much greater than the breadth from north to south. It is an object to have as much north light as possible. This is especially true of biological work. It is, however, not so necessary for Physics and Chemistry. In the work in Physics, sunlight may often be used to advantage and it is well to have one or two windows exposed to the sun. All laboratory rooms should be supplied with gas and water.

In the construction of a new building that is to contain a laboratory, it is important to remember that the windows should be high, running up to the ceiling; that the rooms should not be so deep from the windows on the north to the opposite wall on the south as to render it difficult for light to get readily across, and that the distance from the top of the window sills to the floor should be the same as the height of the laboratory tables. In horizontal measurement, the windows and intervening spaces of brick or stone should be about equal in width. Therefore, in horizontal measurement the north front of a laboratory should be nearly half glass. Too great care cannot be exercised to secure perfect ventilation. The temperature should be kept uniform.

The class room for the recitations in either Physics or Chemistry should be near the laboratory so that apparatus may be readily transferred to and fro. This room should have a demonstration table at least eight feet long, with both water and gas connections. If electrical power is available, this room should be wired for a lantern. Even if no lantern is available, the room should be curtained with opaque enameled cloth shades so that it can be darkened. In Missouri climate there are enough clear days to warrant special attempts to use sunlight in the class room work in Physics. One of the best arrangements is to place the demonstration table with its end toward a south window. Sunlight can then be thrown the length of the table by a mirror (heliostat) placed in the window..

But good rooms and equipment amount to little without good teachers, and the best teachers cannot do good work if opportunity be denied. Every high school in the State should have at least one person

who does nothing but instruct by the laboratory method, and the larger schools should have two or more such teachers.

It is not possible for one person to meet as many classes a day in the laboratory as in the recitation room. If the quota of work for each teacher is six recitations a day, the teacher of science should not be expected to have more than four. Careful preparation for each laboratory exercise is indispensable. In the recitation work in Physics, it is essential that carefully planned demonstration experiments be given. These will require considerable time in preparation, but it is time well spent. Few things in a class room are more pleasing and more instructive than a well executed successful experiment, and few things are more disastrous than the failure of a demonstration.

It is not economy to buy too cheap apparatus. It is always best before purchasing to submit lists to the various apparatus companies for bids.

### PHYSICS

As indicated in the definition of the unit, no special list of experiments is required, each teacher being given considerable latitude in the choice of experiments. Each school should offer about fifty experiments, not attempting to make all the pupils perform the same experiments. Experiments for any particular pupil should be to some extent chosen to meet the individual needs of that pupil. In counting the required thirty experiments, the "preliminary" experiments that appear in some lists must not be included, such experiments as measurements of lengths in centimeters and inches, measurements of areas and experiments designed solely to acquaint the pupil with the fundamental units and their measurement. Each experiment should be planned to illustrate some fundamental principle of Physics and this principle should be clearly brought out.

In equipping the laboratory, it is first necessary for the teacher to choose the laboratory manual and the list of experiments to be offered. When that is done, apparatus to fit that manual and that list can be selected. Apparatus purchased from a list prepared in any other way, will be unsatisfactory, and, in all probability, will not fit the work. The experiments as given in laboratory manuals are usually planned so as to obtain the maximum use of each piece of apparatus, thus reducing the number of pieces necessary to buy. To obtain benefit of this, the apparatus must be selected to fit this plan. If several different experiments are conducted at the same time, not only is the work of the individual pupil more independent, but needless duplication of apparatus is avoided. Thus a greater variety and better grade of apparatus is rendered available.

It is impracticable to make partial lists that are satisfactory. If only a small amount of money is available for apparatus it is best to buy an equipment covering definite portions of the subject as, for ex-

ample, mechanics, heat and sound, which is fairly complete as far as it goes. Future additions are not only more likely to be obtained but can be selected more wisely. Under the instruction of the teacher, some of the necessary apparatus can be made at home. Many things can be picked up here and there that are very useful in the laboratory. For example, small scraps of different metals are useful for density or specific heat determinations. Often scrap iron that costs but little can be used in place of the more expensive large iron weights.

The following list is appended merely to give an idea of the cost of apparatus. *This list must be changed to suit the manual and the experiments given in the course.*

The prices of the starred (\*) items are affected by war conditions and are subject to change. Normal prices are given here.

## FOR TWELVE STUDENTS WORKING AT THE SAME TIME

### MECHANICS AND PROPERTIES OF MATTER

6 30 cm. rulers with protractor on back.....	\$ .18
6 meter rods, with brass tips.....	1.92
$\frac{1}{2}$ lb annealed iron wire, No. 24, on spool.....	.28
$\frac{1}{4}$ lb spring brass wire, No. 27, on spool.....	.30
$\frac{1}{4}$ lb spring brass wire, No. 24, on spool.....	.25
$\frac{1}{2}$ lb bare copper wire, No. 32, B. & S. gauge.....	.35
4 8 oz. spring balances, graduated in both English and metric units with flat backs, broad pointers.....	3.24
4 64 oz. spring balances, graduated in both English and metric units with flat back, broad pointers.....	2.00
6 white pine rods, straight grained, $41 \times \frac{1}{2} \times \frac{1}{2}$ ".....	.30
6 white pine rods, straight grained, $41 \times 1 \times \frac{1}{2}$ ".....	.36
2 sets iron weights, universal 1000 grams to 10 grams.....	3.60
4 mounted uprights 10 cm. scales, divided in mm.....	.64
12 hardwood prisms.....	.48
1 each steel bicycle balls, $\frac{1}{4}$ " & $\frac{3}{8}$ " dia....	.08
6 pulleys, wooden, cone bearing.....	2.40
3 sets rods for same.....	.19
1 steel rule, 20 cm. long, graduated in mm. & in.....	.90
1 Jolly balance, all metal.....	4.50
1 torsion apparatus after model of Carmen, complete with rods..	12.00
*1 micrometer-caliper, metric, 13 mm., friction head.....	3.00
*1 vernier caliper, English and metric, inside and outside jaws, depth gauge.....	2.25
*1 spherometer reading to 1—100 mm.....	3.00
1 "Cenco" triple beam balance complete (if a good beam balance is not available).....	12.60

1 metal cylinder, iron, about 50 mm. long, 12 mm. diam., for density determinations.....	\$ .15
1 metal cylinder, brass, about 50 mm. long, 12 mm. diam., for density determinations.....	.15
1 metal cylinder, aluminum, about 50 mm. long, 12 mm. diam., for density determinations.....	.15
2 smooth pine boards, 50x15x2 cm., for friction.....	.22
2 7" hand screw clamps, No. 14.....	.72
3 waterproof cherry blocks, 3x3x1½".....	.30
2 platform balances, Harvard trip agate bearing.....	12.00
*2 sets weights, 1000 to 5 grams.....	2.15
*2 sets weights, 5 to 0.01 grams.....	.40
5 waterproof loaded rectangular blocks.....	.90
1 lb sulphur rolls.....	.10
6 lead sinkers.....	.70
5 round waterproof rods, 8x½".....	.25
*4 Sp. Gr. bottles, 50 cc. approximately.....	1.45
*4 glass "J" shaped tubes, closed at one end for Boyle's law....	2.40
2 "Y" tubes of lead.....	.36
*6 lb mercury and bot.....	5.25
12 small glass tumblers.....	.40
*12 glass tubes, 50 cm. long, 5 mm. diam.....	.40
6 screw pinchcocks.....	1.08
6 ft. rubber tubing, ¼" diam.....	.54
2 bottles, 2 liters capacity with stoppers, rubber, 1-hole, glass tube, rubber tube, and pinch cock.....	1.30
1 condensing and exhausting pump (if better is not available)..	3.25
2 lb paraffine.....	.30
*1 barometer tube, 80 cm. long, 5 mm. bore, closed at one end..	.25
1 Nicholson's hydrometer.....	1.20
*1 jar for hydrometer, 12x2.....	.34
2 boards for composition of forces, 58x84 cm. with ring, and pegs.....	3.00
2 cars for inclined plane.....	1.80
2 pulleys for same.....	.60
4 iron balls, 25 mm. diam., for pendulum, ground and polished..	.32
1 Pr. Ivory balls, 50 grams and 150 grams.....	4.00
<hr/>	
Total for mechanics and properties of matter.....	\$101.25

## HEAT

*6 flasks, 125 cc., flat bottom.....	\$ .32
*3 air thermometer tubes, 2" bulb.....	.46
*12 thermometers—10 to 110 c, stem scale Jena glass.....	9.60
2 linear expansion apparatus, all metal with N. P. brass tube, lever reading.....	4.80



5 lb. shot, No. 6.....	\$ .70
8 calorimeters, polished, N. P.....	2.88
4 Harvard apparatus "A" new style, with detachable tripod...	8.00
*1 lb heavy walled glass tubing, 1 to 2 mm. internal diam.....	.60
3 iron supports, 2 rings each.....	1.20
3 sheets brass wire gauze, 4x4".....	.21
100 grams pure paraffine for melting point determination.....	.10
*2 nests beakers, No. 1 to 3.....	.80
*4 Florence flasks, 12 oz.....	.50
*4 Florence flasks, 16 oz.....	.65
*4 Florence flasks, 8 oz.....	.47

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Total for heat.....\$ 31.29

## SOUND

*1 Kundt's apparatus with brass and steel rod, improved form..	\$ 3.30
1 sonometer with pulley for weights, 2 strings.....	4.50
*2 annealed glass resonance tubes, open at both ends about 2.5 cm. diam., 120 cm. long, with sliding rod and piston sup- port.....	3.60
*1 tuning fork, C 128, 10" long.....	1.80
*2 tuning forks, C 256, 7 $\frac{1}{4}$ " long.....	2.00
*2 tuning forks, A 426, 6 $\frac{1}{4}$ " long.....	1.26
*2 tuning forks, C 512, 5 $\frac{7}{8}$ " long.....	1.26

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Total for sound.....\$ 17.72

## LIGHT

1 box to illustrate formation of images.....	\$ .63
*12 plane mirrors, 4x15 cm. or 2x6".....	.84
*10 double convex lenses, 10 cm. focus.....	1.00
*10 double convex lenses, 15 cm. focus.....	1.00
6 lens supports.....	.60
6 screen supports.....	.42
6 pin supports.....	.42
6 Walter Smith school squares, med.....	.36
*1 double convex lens, 3.5 cm. diam., 15 cm. focus.....	.10
*3 concave mirrors, brass, N. P.....	.60
*3 triangular glass prisms, 4" long.....	.75
*2 pieces heavy plate glass for refraction.....	.36
4 lb. paraffine candles, twelve.....	.64

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Total for light.....\$ 7.72

## MAGNETISM AND ELECTRICITY

1 lb. fine iron filings.....	\$ .15
24 steel knitting needles.....	.20
10 bar magnets, 6".....	1.50
*4 compasses, 40 mm. diam., needle, 3 cm. long.....	.88
3 Sq. ft. heavy zinc sheet, 1-16" thick.....	1.23
1 galvanoscope frame.....	1.12
12 lead strips, 1x10 cm., with wire.....	1.20
4 Sq. ft. sheet copper, No. 24.....	2.70
10 glass battery jars, 4x5".....	1.50
6 porous cups, 5x10 cm.....	.80
4 commutators.....	2.40
12 double connectors, brass.....	.96
¼ lb. copper wire, No. 30 D. C. C.....	.43
1 lb. copper wire, No. 20, D. C. C.....	.58
¼ lb. German silver wire, No. 30, D. C. C.....	.83
¼ lb. German silver wire, No. 24, D. C. C.....	.58
9 lb. commercial sulphuric acid and GSB.....	.70
1 slide wire Wheatstone bridge.....	2.70
1 set of 8 resistance spools after Hall.....	2.70
6 gravity cells, 6x8 complete.....	4.80
10 lb. copper sulphate.....	1.00
2 resistance boxes, 0.1 to 40 ohms, guaranteed accurate to ½ of 1 per cent.....	13.50
1 tangent galvanometer.....	4.75
2 D'Arsonval galvanometers sensitive to 18 megohms with open coil, sight and scale attachment and leveling screws.....	10.00
10 empty spools for making resistance coils.....	1.00

Total for magnetism and electricity.....\$ 58.21

Total for entire Physics equipment.....\$216.19

## DEALERS IN PHYSICAL APPARATUS

Central Scientific Co., 412 Orleans St., Chicago; Chicago Apparatus Co., 40-42 West Quincy St., Chicago; Wm. Gaertner & Co., 5347-9 Lake Ave., Chicago; T. W. Gleeson, 106 Sudbury St., Boston; A. W. Hall Scientific Co., 141 Franklin St., Boston; L. E. Knott & Co., 15-17 Harcourt St., Boston; C. H. Stoelting Co., 121 North Green St., Chicago. On demand, some of these firms furnish lists of apparatus to fit particular manuals. Many suggestions are also obtained by consulting their general catalogues.

# CHEMISTRY

## FOR TWENTY-FOUR PUPILS, TWELVE WORKING AT ONE TIME

### FIXTURES AND PERMANENT EQUIPMENT

The first cost of the laboratory equipment will depend largely upon the quality of the tables for the pupils and the amount of plumbing. Two tables should be provided, each 12 feet long, with closet room for twelve students, and working space for six at one time. A very serviceable table with a moderate amount of plumbing can be built with a lead lined trough about 4 inches wide along the central length, and sink at one end. At the lower end, the trough should be about 6 inches deep, and heavy lead weighing 4 pounds per square foot should be used. The breadth of each of these tables should be at least 4 feet, preferably 4 feet and 4 inches; the height, 36 inches. If the tables are constructed as cheaply as possible, the cost complete with plumbing and sinks will be approximately \$10 per lineal foot; i.e., about \$120 per table. A table without plumbing will cost at least \$6 per lineal foot. When first class material and workmanship are demanded, including sinks of alberene stone, the cost will be about \$16 per lineal foot. Hence \$150 to \$400 should be allowed for tables.

Very suggestive details for laboratory equipment are given by Professor E. P. Schoch in Bulletin No. 210, University of Texas, entitled *Chemistry in High Schools*.

The European war has caused a marked advance in the prices of nearly all kinds of apparatus and chemicals. Instead of giving liberal discounts on catalogue prices, most dealers make their catalogue quotations net rates.

In addition to tables, the following items should be included in fixtures and permanent equipment:

1 draft hood.....	\$25.00 to \$75.00
1 wall shelf for reagents, liquids and solids.....	\$5.00 to \$10.00
15 one-liter stock bottles with glass stoppers.....	3.75
40 250 cc. (8 ounce) glass stoppered bottles, ("German tinctures") for liquids used as side reagents.....	6.00
60 250 cc. (8 ounce) wide mouthed flint glass bottles for solids as side reagents.....	12.00
6 earthen ware slop jars.....	1.50
1 automatic water still.....	25.00
1 stock and apparatus case, if storage closet or room for appa- ratus is not at hand.....	50.00
3 Kipp apparatus, 1 liter.....	6.00
1 Harvard trip scale, No. 332, Eimer and Amend's Catalog C, 1913.....	6.00

1 set of weights, 1000 grams to 5 grams.....	\$ 2.50
1 balance for quantitative work, E. & A's Cat. No. 300.....	12.50
1 set of weights, E. & A's Cat. No. 506, 1 gram to 200 grams...	2.00
1 siphon barometer.....	8.00
1 blast lamp.....	2.00
1 bellows, foot, Fletcher's, 7 inch.....	4.50
1 Hoffman electrolysis apparatus, E. & A. 4244.....	4.50
1 frame for metric system.....	2.00

(A chart called the International Metric System can be obtained from the Bureau of Standards, Washington, free of charge. It is worth framing.)

1 induction coil for automobile use.....	4.50
1 chart, periodic classification of the elements.....	1.25
2 burettes, Mohr's, for pinch cock, 50 c c.....	1.25
2 burettes, Geissler's with glass cock, 50 c c.....	1.85
1 burette clamp, Lincoln's.....	.50
3 sets of cork borers, 3 in set.....	.90
1 magnet.....	.20
2 magnifying glasses.....	1.50
1 ozone tube, E. & A. 4916.....	2.00

The total for fixtures and general equipment amounts to from \$340 to \$645.

If the class work is to include demonstrations by the teacher, a small lecture table and special apparatus should be provided and the sum of \$50 to \$100 added for this.

#### APPARATUS MORE OR LESS PERMANENT\*

30 nests of beakers, 2½, 4, and 7 ounces, plain Bohemian.....	
30 blowpipes, jeweler's, 8 inch.....	
6 dozen flint glass, wide mouthed bottles, 4 ounce.....	
18 flint glass, wide mouthed bottles, 16 ounce.....	
24 Bunsen burners with air regulator.....	
8 dozen corks, 7-8 inch.....	
4 dozen corks, 1 1-16 inch.....	
12 dozen corks, assorted.....	
18 nests of Hessian crucibles, "threes".....	
4 dozen 1 1-4 inch porcelain crucibles.....	
24 50 cc. graduated cylinders.....	
3 dozen German porcelain evaporating dishes, each 2½ and 3½ inch diameter.....	
12 lead dishes, 2 inch.....	
24 round files, 3 inch.....	
24 three-cornered files, 3 inch.....	

\*These items are not priced as there is considerable variation in prices. A dealer in laboratory supplies will submit an estimate.

24 packages of filter paper, 4 inch.....	
30 flasks, best Bohemian, 4 ounce.....	
30 flasks, best Bohemian, 8 ounce.....	
30 flasks, best Bohemian, 16 ounce.....	
3 dozen German glass funnels, 2½ inch.....	
24 pairs steel forceps, 5 inch.....	
24 gas bottles, 8 ounce.....	
50 rubber stoppers, two holes, to fit gas bottles.....	
5 pounds glass tubing, 1-8 and 3-16 inch bore.....	
2 pounds glass rods, 1-8 inch diameter.....	
2 quires test paper, litmus and turmeric.....	
24 mortars, 2½ inch.....	
4 feet platinum wire.....	
30 2 ounce retorts with stoppers, best Bohemian.....	
48 feet ¼ inch bore rubber tubing.....	
48 feet 3-16 inch bore rubber tubing.....	
30 tin sand baths, 5 inch.....	
4 hand scales, 6 inch beam.....	
4 sets weights, 0.1 gram to 50 grams.....	
24 test tube racks.....	
36 dozen test tubes, 6 inches by 5-8 inch.....	
24 test tube brushes.....	
3 dozen watch glasses, 2 inch.....	
24 squares blue glass.....	
48 hard glass test tubes, 6 inch.....	
6 lamp tips.....	
24 filtering stands, 1 arm, 2 holes.....	
2 dozen iron wire triangles.....	
24 pneumatic troughs, made by fitting half gallon or gallon crock with metal shelf.....	
30 retort stands.....	
1 package filter paper, 10 inch.....	
Total cost, without freight.....	\$200 to \$250

#### CHEMICALS

As the chemicals required will vary somewhat with different textbooks, the list recommended by the text selected should be provided. A very complete list with prices as given in Dr. Schoch's bulletin, referred to above.

#### SUMMARY OF EQUIPMENT

Fixtures and permanent equipment.....	\$650.00 to \$300.00
Apparatus more or less permanent.....	200.00
Chemicals:.....	80.00

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Total, at least.....\$580.00,

## MAINTENANCE

The yearly cost of "apparatus more or less permanent," which must be replaced on account of breakage, will be approximately.....	\$ 60.00
The yearly cost of chemicals, approximately.....	40.00
<hr/>	
Total annual expenditure.....	\$100.00

## DEALERS IN CHEMICAL APPARATUS

Apparatus and supplies may be obtained from the following firms: Eimer and Amend, 205-211 Third Ave., New York City; Wm. Gaertner and Co., 5345-5349 Lake Ave., Chicago; E. H. Sargent and Co., 143-145, Lake Street, Chicago; Henry Heil Chemical Co., 212-214 South Fourth Street, St. Louis; Scientific Materials Co., Pittsburgh, Pa.; Central Scientific Co., 345 West Michigan Street, Chicago; Kewaunee Manufacturing Co., Kewaunee, Wis. (laboratory furniture); Leonard Peterson & Co., 1240-1248 Fullerton Ave., Chicago (laboratory furniture); L. E. Knott Apparatus Co., Boston, Mass.; Bausch and Lomb Optical Co., Rochester, N. Y.; Woldenberg and Schaar, 387 Wabash Ave., Chicago; C. H. Stoelting Co., 121 North Green Street, Chicago; Max Kohl, Chemnitz, Germany; Drs. Peters and Rost, Chaussee Strasse, Berlin, Germany.

## GENERAL BIOLOGY, BOTANY AND ZOOLOGY

## FOR TWELVE PUPILS WORKING AT THE SAME TIME

## APPARATUS

6 compound microscopes, from \$20 to \$30 apiece....	\$120.00 to \$180.00
2 laboratory tables, with drawers, 96 inches long, 36 inches wide, 29 inches high, heavy white pine, oiled top.....	20.00
12 pair scissors, fine.....	6.00
12 scalpels.....	3.00
12 pairs forceps, medium fine, straight points.....	4.80
24 dissecting needles.....	1.00
6 section razors.....	6.00
12 dissecting lenses, one-inch focus (or reading glasses 2½ inches in diameter).....	12.00
1 balance, with weights.....	4.25
2 gross glass slides, 3x1 inches.....	2.00
4 ounces cover-glasses, ¾ inch square.....	3.20
24 Syracuse watch glasses.....	1.25
24 pipettes, with rubber bulbs.....	.75
2 pounds glass tubing, assorted sizes.....	1.50

1 lot large flat dishes, glass or porcelain.....	.....
24 Fruit jars with large mouths, quart.....	\$ 2.00
24 test tubes.....	.38
1 lot guarded bristles.....	.....
1 galvanized iron waste can, with cover.....	1.25
1 lot battery jars, large.....	.....
1 package filter paper.....	.50

## REAGENTS AND CHEMICALS

10 pounds formalin.....	2.50
1 gallon alcohol, 95 per cent.....	4.00
1 quart absolute alcohol.....	1.90
1 pound ether.....	.85
1 pound mercury.....	1.50
2 gallons distilled water.....	.....
1 pound glycerine.....	.50
1 pound turpentine.....	.15
½ pound cedar oil.....	.75
3 ounces balsam, in xylol.....	.60
1 pound glacial acetic acid.....	.50
1 pound sulphuric acid.....	.30
1 pound hydrochloric acid.....	.15
1 pound nitric acid.....	.50
½ pound picric acid, crystals.....	.75
½ pound corrosive sublimate.....	.60
1 pound chloroform.....	.75
1 pound caustic potash.....	.40
½ pound potassium cyanide, fused lumps.....	.45
1 ounce iodine, resubl.....	.60
½ ounce methyl green.....	.40
6 ounces haemalum, solution.....	.60
3 ounces acid carmine, solution.....	.70
½ ounce orange G, powder.....	.45
1 ounce pith, for sectioning.....	.10
½ ounce optical carmine.....	.50

*All of the above are normal list-prices, except those for compound microscopes, which are special prices for schools. The prices of many chemicals have been advanced by the European war.*

Although all of the articles given in the above lists are recommended, nevertheless good work can be done with a smaller equipment. In the average school much will depend upon the teacher's ingenuity in devising substitutes for apparatus at little or no expense. Aquaria for keeping aquatic forms alive in the laboratory are necessary and for this purpose large battery jars will be found satisfactory. One dozen tumblers, some

wide mouthed bottles with corks for water or sand cultures, a few thistle tubes, some rubber stoppers, rubber tubing, beeswax or paraffine, and some bibulous paper will be found helpful additions for any work in plant physiology. A few stoneware saucers will also be found indispensable for work on the germination of seeds. Insect cages may be readily made of wire or cotton netting placed over pans or trays filled with earth in which the plants, used as food by the insects, are growing. These, and many other contrivances, for making observations and experiments upon living animals and plants in the laboratory are of the greatest value, as the chief stress should be laid upon this phase of the instruction.

#### DEALERS IN ANIMALS FOR CLASS WORK

F. J. Burns & Co., 214 W. So. Water St., Chicago, Ill.; A. A. Sphung, North Judson, Ind.; Alex. Nielson, Venice, Erie Co., Ohio (living and preserved material); Harpswell Laboratory, Tufts College, Mass.; Marine Biological Laboratory, Supply Department, Woods Hole, Mass. (marine specimens); Powers and Powers, Station A, Lincoln, Neb. (living hydra, protozoa, etc., and microscopic slides); Zoological Supply Department, University of Missouri. (This department is prepared to furnish to the schools of the state living and preserved material from the local fauna, and also the marine forms ordinarily used. In addition to the forms used for student dissection, simple museum specimens and microscopic preparations may be secured. All supplies will be furnished *at cost*, and the schools will have the further advantage of low transportation charges and prompt delivery. The department is not in operation between June 1st and October 1st. The current price list and further information may be obtained by addressing the Zoological Supply Dept., Biology Bldg., Columbia, Mo.)

#### DEALERS IN LABORATORY APPARATUS AND SUPPLIES FOR BOTANY AND ZOOLOGY

Bausch and Lomb Optical Co., Rochester, N. Y. (microscopes and supplies); Cambridge Botanical Supply Co., Cambridge, Mass. (general botanical equipment, preserved material and fresh marine algae); Drury, Miss E. M., 45 Munroe Street, Roxbury, Mass. (slides and botanical material); Eimer & Amend, 205-211 Third Ave., N. Y. (general apparatus, supplies, and reagents); Ernest Leitz, 30 E. 18th St., N. Y. (microscopes and supplies); Spencer Lens Co., Buffalo, N. Y. (microscopes and supplies).

#### PHYSIOLOGY

The apparatus and chemicals necessary for the accurate measurement and observation of the activity of such organs as the heart, respiratory system, muscles, nerves, etc., and for the chemical study of the blood,



the digestive process, etc., can be had at a comparatively small cost. The lists given below contain some things for which the ingenious teacher may himself make very effective substitutes at little cost, save time and his own labor. The minimum outfit for effective work is as follows:

GENERAL EQUIPMENT

Student tables, size of top about 34x54, height 34 inches...	} \$100
Stools, two to each table.....	
Gas, water, and electric connections for an electric clock....	
General chemical table and shelves.....	
General supply of chemicals.....	
Electric clock, Harvard form or simple wall pendulum, beating seconds, with mercury contact and electric connections.....	

GENERAL APPARATUS FOR DEMONSTRATION

1 stethoscope, Bowles.....	3.50
1 mercury manometer and blood pressure outfit.....	5.00
1 set of test lenses for the eye.....	6.00
1 color wheel, or a small electric motor, with set of color discs..	7.00
Assorted glass tubing.....	1.00
Assorted rubber tubing.....	1.50
Assorted corks.....	1.00
1 shellac outfit.....	1.00

SPECIAL SETS OF APPARATUS AND CHEMICALS

FOR EACH GROUP OF FOUR STUDENTS WORKING TOGETHER

For physiological experiments.

1 table, size about 34x54x34 inches.....	\$10.00 to \$ 20.00
2 stools, height 20 inches.....	1.00
1 recording drum and clockwork.....	24.00
1 induction coil.....	7.00
1 platinum stimulating electrode.....	1.00
2 dry batteries.....	.50
2 porcelain base (knife edge), electric keys.....	.30
1 muscle lever.....	1.15
1 muscle clamp.....	1.00
100 weights, 10 gram, lead.....	.30
1 heart lever, of straw.....	.00
1 heart lever holder (use muscle lever holder).....	.00
1 signal magnet (electric, for the time circuit).....	1.05
1 tuning fork, 100 double vibrations a second.....	1.00
2 iron stands, heavy base (chemical stands will serve).....	2.00

2 burette clamps, simple.....	\$ .60
2 burette clamps, universal.....	.80
100 sheets glazed paper, 6x20 inches.....	.50

For physiological chemical experiments.

1 set chemical apparatus, containing 6-inch file, 100 filter papers, 4-inch funnel, bunsen burner, 100 c. c. graduated cylinder, 4-inch flat bottom evaporating dish, 300 c. c. flask, test tube rack and dozen test tubes, set of 6 beakers, 100° centigrade thermometer, costing in all about.....	6.00
1 set student chemicals containing starch, dextrine, dextrose, acetic acid, nitric acid, hydrochloric acid, picric acid, ammonia, caustic soda or potash, sodium chloride, magnesium sulphate, ammonium sulphate, calcium chloride, copper sulphate, sodium potassium tartrate, glycerine, pepsin, ptylin, pancreatin and fibrin, costing in all about.....	6.00
1 set chemical reagent bottles.....	4.00
Total.....	<hr/> \$204.20

DEALERS IN APPARATUS

Harvard Apparatus Co., Back Bay P. O., Boston, Mass.; Eimer and Amend, New York City, N. Y.

DEALERS IN CHEMICALS

Mallinckrodt Chemical Co., St. Louis, Mo.; Merck & Co., St. Louis, Mo.

PHYSICAL GEOGRAPHY

FOR TWELVE PUPILS WORKING AT THE SAME TIME

1 globe, 12-inch or Jones' relief globe.....	\$6.00-\$7.50
100 lbs modeling clay.....	3.00
1 set physical maps of the continents, Goode's, Rand McNally & Co., Chicago; or Johnson's, A. J. Nystrom Co., Chicago; or Kuhnert's, A. J. Nystrom Co., Chicago. (Approx.).....	30.00
1½ dozen chemical thermometers.....	3.00
2 relief maps (in brown) of U. S., U. S. Geol. Surv.....	.20
1 wind vane (made by students).....	....
Daily weather maps (free from nearest Weather Bureau station).....	....
1 barometer, standard mercurial.....	....
1 hand compass.....	1.00

1 hammer, tinner's or mason's, for breaking rocks and mineral specimens.....	\$ .60
Hydrochloric acid.....	.10
1 tape, 50 foot.....	.50
1 plane table, made by using light board about 15" by 15" on a heavy camera tripod.....	2.50
1 set of about 20-25 minerals and rocks. (The Dept. of Geology at the University will furnish minerals and rocks, enough for a class of 10 or 15, at cost.) (Approx.).....	3.00
Pictures illustrating land forms. (These may be either large photographs, stereoscopic views, or lantern slides. Colored pictures about 8"x10" may be purchased from the Detroit Photographic Company for 25c. each; uncolored ones are cheaper.)	
Stereoscopic views, each (Approx.).....	.10
Stereoscope (1 or 2 is enough for class of 10 or 15), each.....	.50
Lantern, College Bench, McIntosh Lantern Co. (Approx.).....	30.00
Lantern slides, each.....	.40
(Catalogues of stereoscopic views and lantern slides may be obtained from the Keystone View Co., St. Louis, Mo.; Underwood & Underwood, 83 Locust Street, Arlington, New Jersey; Central Scientific Company, Chicago, Illinois; MacIntosh Stereopticon Company, Chicago, Illinois.)	

#### TOPOGRAPHIC MAPS AND COAST CHARTS

Coast Charts may be purchased from the Coast and Geodetic Survey, Washington, D. C., at a cost of about fifty cents each. One chart on each subject is sufficient. Topographic maps should be ordered from the United States Geological Survey, Washington, D. C. The topographic maps cost six cents each in lots of one hundred. The number of copies of each topographic map needed will depend upon the number of pupils in the class and the plan of work. There should be one map of each subject for each two students, whether working in one section or in more than one section. If the class is divided into groups and each group studies different sheets, fewer copies of each will be needed. Teachers may select from the following list the maps needed for class work and for more detailed study in the laboratory:

Young volcanoes: Mount Shasta Special, Cal.

Old volcanoes: San Francisco Mt., Ariz.; or Marysville, Cal.

Fault scarp: Mount Trumbull, Ariz.; or Klamath, Oregon.

Sand dunes: Norfolk, Va.-N. C.; and Kinsley, Kans.

Sink hole: Standing Stone, Tenn.; or Kingston, Tenn.

Erosion forms in deserts: Petrified Forest, Ariz.; or Winkelman, Ariz.

Ravines: Highwood, Ill.; or Dunlap, Ill.

Canyons: Echo Cliff, Ariz.; or Bright Angle, Ariz.

Young valleys: Fargo, N. D.-Minn.; and Watrous, N. M.

Mature valleys: Guyandot, W. Va.-Ohio; or Arnoldsburg, W. Va.

Old valley: Princeton, Ind.-Ill.; or Butler, Mo.

Alluvial fan: Cucamonga, Cal.; or Pasadena, Cal.

Natural levee: Donaldsonville, La.; or Gibson, La.

Water gaps and wind gaps: Hollidaysburg, Pa.; or Delaware Water Gap, Pa.-N. J.

Waterfalls: Niagara River and vicinity, N. Y.

Stream capture: Kaaterskill, N. Y.; and Harper's Ferry, Va.-W. Va.-

Md.

Intrenched meanders: Harrisburg, Pa.; or Arnoldsburg, W. Va.

River terraces: Marseilles, Ill.; and Hartford, Conn.

River cut-offs: Miss. R. Com., Prelim. Map Sheet 18; and Millikin,

La.

Deltas: Watkins, N. Y., Coast Chart No. 194, Mouth of Mississippi River.

A filled-in basin: Sierraville, Cal.

Braided river: Stromsberg, Neb.; or Paxton, Neb.

Alluviation, flood plain, and bars: Leavenworth Special, Kans.-Mo.; or Waukon, Iowa; Wis.

Drainage in region of folded rocks: Monterey, Va.-W. Va.; or Harrisburg, Pa.

Imperfect drainage: Waterloo, Wis.; Parmalee, N. Car.

Perfect drainage: Guyandot, W. Va.-Ohio; or Arnoldsburg, W. Va.

Erosion cycles: Harrisburg, Pa.; or Delaware Water Gap, Pa.-N. J.

Drowned river: Wiconico, Md.-Va.; or Saybrook, Conn.

Terminal moraine: St. Croix Dalles, Wis.-Minn.; or Martha's Vineyard, Mass.; or Ann Arbor, Mich.

Ground moraine: Evansville, Wis.; or Milwaukee, Wis.; or White-water, Wis.

Drumlins: Sun Prairie, Wis.; and Auburn, N. Y.

Out-wash plain: Whitewater, Wis.; or Martha's Vineyard, Mass.

Lakes due to glacial erosion: Newcomb, N. Y.; or Old Forge, N. Y.

Morainic lakes: Dexter, Mich.; and Baraboo, Wis.

Drainage changes: Elmira, N. Y.; and Baraboo, Wis.

Alpine glaciers: Mt. Shasta, Cal.; and Chief Mountain, Mont.

Cirques: Hayden Peak, Utah-Wyo.; and Chief Mountain, Mont.

Fiords: Booth Bay, Me.; and Coast Chart No. 313, or same region.

Sandy coast: Martha's Vineyard, Mass.; or Coast Chart No. 123, Absecon Inlet to Cape May; Sandy Hook, N. J.

Land tied island: Boston Bay, Mass.

Rocky coast: Tamalpais, Cal.; and Coast Chart No. 5581, San Francisco Entrance.

Sunken or drowned coast (See for drowned river).

Elevated shore lines: Oceanside, Cal.; and Niagara Falls and vicinity, N. Y.

# AGRICULTURE

## MINIMUM EQUIPMENT FOR A CLASS OF SIXTEEN PUPILS

2 doz. student lamp chimneys, 75c.....	\$ 1.50
2 doz. wide-mouthed bottles, per doz. 26c., 1 oz.....	.52
2 doz. wide-mouthed bottles, per doz., 45c., 6 oz.....	.90
4 thistle tubes, 10c.....	.40
1 lb. glass tubing, one-fourth inch.....	.44
4 thermometers, chemical, centigrade, at 60c.....	2.40
6 doz. test tubes, 8x1.....	3.00
1 "Cenco" trip scale.....	6.65
1 set weights.....	1.65
1 Babcock milk and cream tester.....	5.50
8 shallow pans, at 35c.....	2.80
4 glass funnels, 3-inch, at 12c.....	.48
2 sieves, 20 mesh	} 6.45
2 sieves, 60 mesh	
1 sieve, 100 mesh	
1 lb. glass rods—small.....	.50
1 lb. glass tubing—small diameter.....	.50
8 tripod microscopes, 44c.....	3.52
1 soil auger.....	3.00
2 percolation cylinders.....	3.50
2 evaporation cylinders.....	5.00
2 graduated cylinders, 65c., 100cc.....	1.30
3 blast lamps, gasoline, \$2.75.....	8.25
Total.....	\$58.26

(The apparatus listed above when purchased in one order will cost about \$51.00, transportation charges prepaid.)

## MATERIAL TO BE PURCHASED AT HOME

- 4 Mason's pint fruit jars.
- 3 doz. 6 inch flowerpots with saucers.
- 4 doz. 4 inch flowerpots with saucers.
- 16 heavy dinner plates.
- 16 panes of glass, 8x11.
- 1 tiling spade.
- 1 table, 3½ ft. x 12 ft.
- 1 suitable case for storing apparatus.

At least an acre of ground should be provided. This can be purchased or leased.

## APPARATUS NOT REQUIRED, BUT VERY DESIRABLE

2 soil thermometers.....	\$2.50
1 dissecting microscope.....	9.50
1 bucket sprayer.....	5.00

The apparatus may be purchased of the Central Scientific Company, Chicago, Ill., or any other standard scientific apparatus company. There will be a discount of about ten per cent from the prices listed.

The Missouri College of Agriculture at Columbia will furnish at cost collections of economic seeds, plants and weeds, plant diseases, injurious insects and typical Missouri soils. Much valuable illustrative material may be secured free from large firms engaged in the manufacture of cereal products, fertilizers, etc.

## MANUAL TRAINING

## WOODWORKING

## MINIMUM BENCH EQUIPMENT

Bench, open frame without drawer, glued up top 23 in. by 52 in. tool rack, rapid-acting vise, approximate cost.....	\$ 10.00
Jack-plane, Stanley or Bailey No. 5, each.....	1.85
Wooden mallet, Stanley No. 1.....	.13
Rule, Stanley No. 34.....	.17
Hammer, Maydole bell-faced claw, 13 oz.....	.50
Chisels, socket firmer, Buck Bros., $\frac{3}{8}$ " and $\frac{3}{4}$ " both.....	.85
Marking-gage, Stanley No. 62.....	.12
Try-square, Stanley No. 20, 7 $\frac{1}{2}$ ".....	.24
Back-saw, 12".....	1.10
Swedish sloyd knife No. 7.....	.40
Bench brush.....	.30
Bench-hook.....	.25
Chisel-board.....	.00
Total list price.....	\$ 15.91

## MINIMUM INDIVIDUAL EQUIPMENT

1 jack-plane single iron.....	\$ .25
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## MINIMUM GENERAL EQUIPMENT FOR TWENTY PUPILS

6 wing dividers, 6", each 23c.....	\$ 1.38
6 pencil compasses, each 15c.....	.90
6 nail sets, cup pointed, assorted sizes, each 10c.....	.60
6 try-squares, Stanley No. 20, 12", each 36c.....	2.16

3 turning-saws and frames, 18", each \$1.00.....	\$ 3.00
6 spokeshaves, Bradshaw and Field or Stanley No. 84, 2½", nut adjusted, each 59c.....	3.54
3 gouges, 1", No. 8, outside bevel, each 43c.....	1.29
2 ratchet braces, 8" sweep, each \$1.45.....	2.90
2 plain braces, 8" sweep, each \$1.08.....	2.16
3 crosscut-saws, 22", 10 pt., each \$1.55.....	4.65
3 rip-saws, 24", 8 pt., each \$1.65.....	4.95
2 planes, Jointer 22", each \$3.03.....	6.06
2 rose head countersinks, each 23c.....	.46
2 screwdriver bits, each 17c.....	.34
4 screwdrivers, 4" blade, fluted handle, each 25c.....	1.00
2 auger-bits, 1¼", each 80c.....	1.60
4 auger-bits, 1", each 60c.....	2.40
2 auger-bits, ¾", each 50c.....	1.00
4 auger-bits, ½", each 35c.....	1.40
4 dowel-bits, ¾", each 27c.....	1.08
4 dowel-bits, ¼", each 27c.....	1.08
4 dowel-bits, ⅜", each 12c.....	.48
1 T-bevel, 8".....	.44
1 monkey-wrench, 8".....	.50
1 pair combination pliers, 6".....	.40
2 combination India oilstones, 6"x2"x1", in iron boxes, each \$1.00	2.00
1 oil-can, ¼ pt., each 18c.....	.18
6 handscrews, No. 812, each 40c.....	2.40
2 steel bar carpenter clamps, 2½ ft., each \$1.69.....	3.38
1 set steel figures, ⅜", each \$1.88.....	1.88
1 shellac can, 1-qt.....	.25
1 kerosene glue heater, 2-pts.....	1.50
1 steel framing-square.....	1.00
6 coping-saws with blades, each 25c.....	1.50
2 brad-awls, each 15c.....	.30
2 scribe-awls, each 15c.....	.30
1 Pyko peerless dry emery grinder.....	6.00
1 Stanley combination plane.....	6.00

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Total list price.....\$ 72.46

#### LIBERAL BENCH EQUIPMENT

Where money is available for individual edged tools, the benches best suited are of the cabinet type having drawers below in which each student may keep his individual edged tools. Such a bench with drawers enough to accommodate all the boys that will be able to make use of the bench during the day, with a hinged or revolving board upon which may be fastened the general tools that belong to that bench, will cost approxi-

mately \$16.50. This includes a first class rapid-acting vise. The following tools should be added to those specified for the minimum bench equipment:

Smooth-plane, 1 $\frac{3}{4}$ " cutter, 8" long.....	\$ 1.66
Jointer-plane, 2 $\frac{3}{8}$ " cutter, 22" long.....	3.03
Screwdriver, 6".....	.35
T-bevel, 6".....	.40
Combination India oilstone, 1"x2"x6".....	1.00
Oil-can.....	.18
Crosscut-saw, 20", 10 pt.....	1.40
Rip-saw, 22", 8 pt.....	1.55
Spokeshave, 2 $\frac{1}{2}$ " blade, Bradshaw and Field or Stanley No. 84..	.57
Total list price.....	\$ 10.14

#### LIBERAL INDIVIDUAL EQUIPMENT

Provide for each drawer, that is, provide each boy with the following:

Chisel, 1", bevel edged, firmer socket.....	\$ .57
Chisel, $\frac{1}{4}$ ", bevel edged, firmer socket.....	.41
Chisel, $\frac{3}{8}$ ", socket mortise.....	.40
Plane-iron for jointer.....	.29
Plane-iron for jack-plane.....	.25
Plane-iron for smooth-plane.....	.23
Spokeshave-iron.....	.15
Sloyd knife, 2 $\frac{5}{8}$ ".....	.40
Total list price.....	\$ 2.70

This list presupposes that the mortising of the first year will be done by chisel alone, no boring. If mortises are to be bored first, it will be advisable to equip each bench with an 8" ball bearing brace, cost \$1.45.

#### LIBERAL GENERAL EQUIPMENT FOR TWENTY FOUR PUPILS

In addition to the general tools specified for the minimum equipment, make the following changes and additions:

Omit emery grinder.

Omit the rip- and crosscut-saws.

Omit the plain braces in case the bench is so equipped.

Omit handscrews and clamps, and glue heater.

Add 1 doz. handscrews, cost each 40c.....	\$ 4.80
Add 2 doz. carpenters' clamps, wood bar, 2-ft., each .85.....	20.40
Add 1 doz. carpenters' clamps, wood bar, 4-ft., each .95.....	11.40
Add 1 set steel letters, $\frac{3}{16}$ ", each \$1.88.....	1.88
Add 1 steam or electric glue heater, each \$9.50.....	9.50
Add 2 draw-knives, 8", each .65.....	1.30



Add ½ doz. steel cabinet scrapers, each .10.....	\$ .60
Add 1 set auger-bits in box, each \$4.00.....	4.00
Add electric grinder and motor.....	50.00
Add 1 bandsaw and motor.....	150.00
Total list price.....	\$253.88

## DEALERS

Schroeter Bros., Hardware Co., 717-719 Washington Ave., St. Louis, Mo.; Simmons Hardware Co., St. Louis, Mo.; Orr & Lockett Hardware Co., 71-73 Randolph St., Chicago, Ill.; E. H. Sheldon & Co., Muskegon, Mich.; Hammacher, Schlemmer & Co., 4th Ave. & 13th St., New York City; The Chas. A. Strelinger Co., 96 Bates St., Detroit,

## MECHANICAL DRAWING

## FOR A CLASS OF TWENTY PUPILS WORKING AT THE SAME TIME

20 drawing tables, top 40x26, cabinet style.....	\$240.00
20 sets of drawing instruments.....	70.00
20 T-squares (cherry).....	8.00
20 triangles, 45, 7 in.....	8.00
20 triangles, 30x60, 7 in.....	7.00
20 white pine drawing boards, 20x25 inches.....	18.00
20 architects' triangular scales.....	8.50
20 irregular curves.....	9.60

Each pupil should possess the following:

1 dozen thumb tacks.....	.05
1 pencil and ink eraser.....	.05
1 sponge eraser.....	.10
1 sketch book, for pencil.....	.10
1 pencil, soft, finest grade, No. 2.....	.10
1 pencil, 4 H, for mechanical drawing.....	.05
1 bottle Higgins' black drawing ink.....	.25

Drawing paper in large sheets, size 19x24, of good quality, for mechanical drawing, may be had from 2 to 5c per sheet.

(In many communities pupils are required to purchase instruments.)

## DEALERS IN DRAWING MATERIAL

The following firms are among those which are reliable: Eugene Dietzgen Co., Chicago; F. Weber & Co., St. Louis; A. S. Aloe Co., St. Louis; Keuffel & Esser Co., St. Louis.

## HOUSEHOLD ARTS

## FOR SIXTEEN STUDENTS WORKING AT A TIME

## COOKING

The following list of equipment is intended to be suggestive. The prices quoted are only approximate. In the case of such things as desks, refrigerator, supply cabinet and cupboards, cheaper equipment may be secured, if necessary. Detailed information with regard to equipment may be found in *Equipment for Teaching Domestic Science* by Helen Kinne. Whitcomb & Barrows, Huntington Chambers, Boston, Mass. The price of this book is eighty cents.

1 gas range.....	\$ 21.00
1 gasoline stove, with oven (if there is no gas).....	10.00
16 individual stoves, each.....	.75
8 desks, each 5 ft. long, each.....	25.00
16 stools, each.....	.50
1 sink.....	4.00
1 refrigerator.....	25.00
1 supply cabinet.....	10.00
1 grocery cupboard.....	5.00
1 china cupboard.....	10.00
1 set scales.....	3.00
1 microscope.....	20.00
8 dishpans, each.....	.25
8 tin boxes for flour, each.....	.08
8 tin boxes for sugar, each.....	.08
8 plates for soap and sapolio, each.....	.05
100 test tubes.....	1.00
Litmus paper.....	
1 Box of corks.....	
1 box of matches.....	.03
8 thermometers, each.....	.30
4 shallow biscuit pans, made to fit the oven.....	.40
8 biscuit cutters, each.....	.05
1 roasting pan.....	.25
2 deep iron kettles.....	.75
2 wire baskets, each.....	.10
2 draining spoons.....	.06
1 large grater.....	.05
2 large stew kettles, each.....	.50
2 large double boilers, each.....	.25
4 ice cream freezers, 1 qt.....	5.00
2 doz. fruit jars.....	1.50
2 doz. jelly glasses.....	2.00

8 muffin rings.....	\$ 2.00
1 meat grinder.....	1.25
1 coffee pot (percolator).....	3.50
1 flour sifter.....	.10
1 tea kettle.....	.75
6 small tin buckets.....	.30
1 large sauce pan.....	.25
1 carving knife.....	.25
1 tea pot.....	.25
2 scrubbing brushes, each.....	.15
40 dish cloths, linen, $\frac{1}{4}$ yard in length.....	2.00
50 dish towels, linen, 1 yard in length.....	7.50
16 sets of apparatus, as follows:	
1 tablespoon.....	\$ .06 $\frac{2}{3}$
2 teaspoons, each.....	.03 $\frac{1}{3}$
1 salt spoon.....	.05
1 wooden spoon.....	.05
1 fork.....	.07
1 spatula.....	.25
1 paring knife.....	.05
1 measuring cup.....	.08
1 mixing bowl.....	.50
1 large baking dish.....	.35
1 ramekin.....	.10
1 plate (porcelain).....	.10
1 pie tin.....	.03
1 clover egg beater.....	.10
1 egg whip.....	.02
1 rolling pin.....	.30
1 molding board.....	.10
1 deep cake and bread pan.....	.10
2 sauce pans, each.....	.25
1 cover for sauce pans.....	.05
1 frying pan.....	.08
1 wire strainer.....	.10
1 double boiler.....	.25

#### SEWING

This list, as the preceding one, is intended to be suggestive. The prices quoted are only approximate. In the case of tables, cabinets and teacher's desk, cheaper equipment may be secured.

4 tables, each 10 ft. in length, each.....	\$ 16.00
16 chairs, each.....	.75
2 cabinets, each.....	10.00
1 teacher's desk.....	15.00

1 mirror.....	\$ 6.00
4 sewing machines, each.....	25.00
16 sets as follows:	
1 12-inch ruler.....	.05
1 yard ruler, metal edge.....	.20
1 pair scissors.....	.75
1 tape measure.....	.05
1 pin cushion.....	.10
1 emory.....	.05
1 work box.....	.10

### III

## SUGGESTIONS FOR THE EQUIPMENT OF LIBRARIES

### GENERAL INFORMATION

In accordance with the law approved March 19, 1901, it is made mandatory upon the district boards of directors to set aside, out of the levy for incidental purposes, not less than five nor more than twenty cents per pupil enumerated in the district each year, which shall be spent, under the direction of the board, in purchasing books, the first hundred of which shall be from a list selected by the State Library Board. (R. S. 1909, Sec. 8186.)

In addition to this provision, the qualified voters in each school district (outside of an incorporated city) have the power, at the annual meeting, by a majority of the votes cast, to vote such a sum as they may deem proper, not to exceed two mills on the dollar, for the purchase of books for a district library. (R. S. 1909, Sec. 8196.)

In cities containing 1,000 and less than 100,000 inhabitants, the Board of Education has power "to establish and maintain a library for the use of the public school district therein," and to appropriate the following sums therefor: 20,000 and under 100,000 inhabitants, \$2,500; 5,000 and under 20,000, \$500; 1,000 and under 5,000, \$250. (R. S. 1909, Sec. 10871.)

This is, in brief, the state of the law in Missouri in reference to the school library. The list of books spoken of in the first paragraph, which may be obtained from the State Superintendent, contains largely books suited to the lower grades. It is with the hope of stimulating the growth of the high school libraries throughout the State and directing that growth in the right direction that these suggestions are made.

Books can generally be purchased to the greatest advantage through some large retail book shop, such as that of A. C. McClurg, 215 Wabash Avenue, Chicago, for domestic books and that of G. E. Stechert, 151 West 25th St., New York, for foreign books. Low discounts may usually be secured from local book-sellers. It is seldom of advantage to deal with the publisher direct. *If a large order is sent, a discount of about thirty per cent from the prices named in the following lists may be expected.* The discount will vary on different books and on some no discount can be given. In writing for books, one should be particular to state *exactly* what is wanted, giving author, title, edition, and publisher.

When the books arrive, they should be compared with the order and the bill, and entered in an accession book. This book, which can be obtained already ruled from the Library Bureau, 156 Wabash Ave., Chicago, is intended to be an exact record of the books in the library and is ruled for author, title, publisher, date, size, binding, house from which purchased and cost. This record is simply intended for business purposes. It is not a catalogue in any sense. One line is given to each volume and each line is numbered consecutively. Each volume, then, has a separate number which should be entered in some stated place on the volume itself, such as the foot of the page following the title.

Before the books are circulated, they should be marked indelibly in several places with the name of the library. A rubber stamp for this purpose can be had for a few cents. For example, the title page, the fifty-first page and the last page should be marked. It is a good idea to have a book plate printed and inserted on the inside cover of each book. The leaves of all uncut books should be cut.

If it is possible, a separate room should be set apart for the library. This room should be made attractive and kept open all day long as a study room. If there is no fund from which to pay a librarian, the library should be placed in charge of one of the teachers, who should be held responsible for it. Good aids for the person in charge of the library are Dana's *Library Primer*, Stearns' *Essentials in Library Administration*, Hitchler's *Cataloging for Small Libraries*, Kroeger's *Aids in Book Selection and Binding for Small Libraries*, Brown's *Mending and Repair of Books*, and Ward's *Practical Use of Books*. The *Library Primer*, which costs \$1.00, can be obtained of the Library Bureau, Chicago. The other books in the list, which, with the exception of Ward's *Practical Use of Books* (\$1.00), cost 15c each, can be obtained of the American Library Association, 78 E. Washintgon St., Chicago.

Every means should be used to encourage pupils to read. They should be referred to definite books frequently and should be shown the books by the teacher. Supplementary reading in moderate quantities should be assigned. Pupils should be permitted to take the books home. During the vacation when the school house is closed, the books should be removed to the home of some one who will care for them and issue them as desired by the residents of the district.

If the library is large enough to warrant the employment of a librarian, some one with a special library training should be employed. It is just as important that the librarian should have a special education as it is for the teacher. If a whole year cannot be given to the study, the librarian should take at least a course at some summer school of library economy.

Every library of over 1,000 volumes should be catalogued on cards. To be effective this work must be done by trained cataloguers. Card cases and other supplies can be had of the Library Bureau. A model catalogue can be secured from the Superintendent of Documents, Wash-

ington, D. C., by sending for a copy of the *A. L. A. Catalogue of 8000 Volumes for a Popular Library*, (price, \$1.00). This is a most carefully selected list and is very useful as an aid in the selection of books. Printed cards of all the books listed can be obtained from the Library of Congress at a cost of two cents for each different card and one-half cent for each duplicate card. The *Handbook of Card Distribution*, which will be sent free, should be secured from the Library of Congress.

The Missouri Library Commission, Jefferson City, Missouri, will be glad to correspond with anyone who wishes suggestions regarding the establishment or administration of school libraries.

#### PUBLISHING COMPANIES

In the book lists names of publishing companies are abbreviated. The full names and addresses of the companies are as follows:

Allyn & Bacon, Boston	Little, Brown & Co., Boston
American Book Company, Chicago	Longmans, Green & Co., New York
D. Appleton & Co., New York	The Macmillan Company, New York
Atkinson, Mentzer & Co., Chicago	Manual Arts Press, Peoria, Ill.
Century Company, New York	Charles E. Merrill Co., New York
Clarendon Press, Cambridge, England	A. J. Nystrom & Co., Chicago
Dodd, Mead & Co., Kansas City	Open Court Publishing Co., Chicago
Doubleday, Page & Co., New York	Orange Judd Company, New York
E. P. Dutton & Co., New York	G. P. Putnam & Sons, New York
Ginn & Co., Boston	Rand, McNally & Co., Chicago
Harper & Bros., New York	Row, Peterson & Co., Chicago
D. C. Heath & Co., Boston	Chas. Scribner's Sons, New York
Henry Holt & Co., New York	Scott, Foresman & Co., Chicago
Houghton, Mifflin Co., Boston	Silver, Burdett & Co., Chicago
Lea & Febiger, Philadelphia	Small, Maynard & Co., Boston
J. B. Lippincott Co., Philadelphia	Whitcomb & Barrows, Boston
	Wiley & Son, New York

#### CLASS NUMBERS

In the book lists which follow, the numbers printed in brackets after the titles of books are the class numbers assigned by the secretary of the Missouri Library Commission. When a book is received, the number following its title should be entered on the first page after the title page and on the label which is pasted on the back of the book. Then the books should be arranged numerically on the shelves. If this is done, books on the same subject will come together.

#### RELATIVE IMPORTANCE OF BOOKS

Books considered to be essential are double-starred, thus \* \*; books which are considered to be next in importance are single-starred, thus \*.

## GENERAL REFERENCE BOOKS

Bartlett, <i>Familiar Quotations</i> , Boston, Little [808.8].....	\$ 3.00
Lippincott, <i>New Gazetteer</i> , Phila. [910.3].....	10.00
* <i>New International Encyclopedia</i> , 2d Ed., 1914-15, 24 Vols., Dodd [0.30].....	120.00
Rand-McNally, <i>Indexed Atlas of the World</i> , 2 Vols. [912].....	25.00
Stephen & Lee, <i>Dictionary of National Biography</i> , 22 Vols., Macmillan [921].....	93.50
Webster, <i>New International Dictionary</i> , Merriam [423].....	12.00

## ENGLISH

## FOR REFERENCE

## LANGUAGE AND RHETORIC

Abbott, E. A., <i>Shakespearian Grammar</i> , Macmillan [822.35].....	\$ 1.50
Bradley, H., <i>The Making of English</i> , Macmillan [420].....	1.00
Bright & Miller, <i>Elements of English Versification</i> , Ginn [426]....	.80
Crabbe, <i>English Synonyms</i> , Harper [424].....	1.25
Fowler, N. W. and F. G., <i>King's English</i> , Oxford Univ. Press [425]	1.75
*Genung, J. F., <i>Working Principles of Rhetoric</i> , Ginn [808].....	1.40
*Greenough, B., and Kittredge, G. L., <i>Words and their Ways in English Speech</i> , Macmillan [422].....	1.10
*Hill, A. S., <i>Principles of Rhetoric</i> , New Ed., American [808]....	1.20
Jespersen, O., <i>Growth and Structure of the English Language</i> , N. Y., Stechert [420].....	1.00
*Krapp, G. F., <i>Modern English</i> , Scribner [420].....	1.25
Nesfield, J. C., <i>English Grammar Past and Present</i> , Macmillan [425].....	1.10
Skeat, W. W., <i>An Etymological Dictionary of the English Language</i> , 1910, Oxford University Press [422].....	9.50
Smith, L. P., <i>The English Language</i> , Holt [420].....	.50
*Whitney, W. D., <i>Essentials of English Grammar</i> , Ginn [425]....	.75
Wyld, H. C., <i>The Growth of English</i> , Dutton [420].....	1.00
Wyld, H. C., <i>Historical Study of the Mother Tongue</i> , Dutton [420]..	2.00

## BOOKS ON LITERATURE

Adams, O. F., <i>Dictionary of American Authors</i> , Houghton [928]..	3.00
Alden, R. M., <i>Introduction to Poetry</i> , Holt [808].....	1.25
Alexander, W. J., <i>Introduction to Browning</i> , Ginn [821].....	1.00
Bates, Arlo, <i>Talks on the Study of Literature</i> , Houghton [807]....	1.50
Bennett, A., <i>Literary Taste and How to Form it</i> , Doran.....	.75
Bradley, A. C., <i>Shakespearean Tragedy</i> , Macmillan [822].....	3.25



Brooke, S. A., <i>English Literature from the Beginning to the Norman Conquest</i> , Macmillan [820].	\$ 1.50
Child, C. G., <i>Early Plays</i> , Riv. Ser., Houghton [822].	.40
Corson, H., <i>The Aims of Literary Study</i> , Macmillan [807].	.75
Corson, H., <i>The Voice and Spiritual Education</i> , Macmillan [784].	.75
Corson, H., <i>Introduction to the Study of Robert Browning's Poetry</i> , Heath [821].	1.50
Dixon, W. M., <i>Tennyson Primer</i> , Dodd [821.81].	1.25
Dowden, E., <i>Shakespeare: His Mind and Art</i> , Harper [822.33].	1.75
<i>English Men of Letters</i> , Ed. by J. Morley, 39 Vols., Harper [920].	29.25
*Fairchild, A. H. R., <i>The Making of Poetry</i> , Putnam [808.1].	1.50
*Fairchild, A. H. R., <i>The Teaching of Poetry in the High School</i> , Houghton [807].	.60
Furnivall and Munro, <i>Shakespeare: Life and Work</i> , Cassell [822].	.35
Gayley, C. M., <i>Classic Myths in English Literature</i> , Ginn [820].	1.50
Gosse, E. W., <i>History of Eighteenth Century Literature</i> , Macmillan [802].	1.50
Gummere, F. B., <i>Old English Ballads</i> , Athen. Press, Ginn [821.1].	.80
Gummere, F. B., <i>The Oldest English Epic</i> , Macmillan [821.1].	1.10
Johnson, C. F., <i>Forms of English Poetry</i> , American [821].	1.00
*Lee, S., <i>Life of Shakespeare, Student's Edn.</i> , Macmillan [822.33].	1.00
MacCallum, M. W., <i>Shakespeare's Roman Plays and their Background</i> , Macmillan [822.33].	2.50
Manly, J. M., <i>English Poetry</i> , Ginn [821.08].	1.50
Manly, J. M., <i>English Prose</i> , Ginn [820.8].	1.50
Page, C. H., <i>Chief American Poets</i> , Houghton [810.08].	1.75
Pollard, A. W., <i>English Miracle Plays</i> , Clarendon [822].	1.90
Pound, L., <i>The Periods of English Literature</i> , University of Nebraska Press [820.9].	.75
Raleigh, W., <i>Wordsworth</i> , London, Arnold [920].	2.00
*Ryland, T., <i>Chronological Outlines of English Literature</i> , Macmillan [820.9].	1.75
Saintsbury, G., <i>History of Elizabethan Literature</i> , Macmillan [820.9]	1.75
Saintsbury, G., <i>History of Nineteenth Century Literature</i> , Macmillan [809].	1.50
Schelling, F. E., <i>Elizabethan Drama</i> , 2 Vols., Houghton [822.3].	7.50
Stedman, E. C., <i>American Anthology</i> , Houghton [811.08].	3.00
Stedman, E. C., <i>Victorian Anthology</i> , Houghton [821.08].	3.00
Taine, H., <i>History of English Literature</i> , Holt [820.9].	1.75
Thayer, W. R., <i>Best English Plays</i> , Ginn [822].	1.40
*Tisdell, F. M., <i>Studies in Literature</i> , Macmillan [820.7].	.90
Wendell, B., <i>Literary History of America</i> , Scribner [810.9].	3.00
Woodbridge, <i>The Drama, Its Laws and Technique</i> , Allyn.	.80

## ENGLISH CLASSICS

Addison, J., <i>Spectator</i> , Dutton [824]. . . . .	\$ 1.00
Arnold, M., <i>Essays in Criticism</i> , 2 Vols., Macmillan [824]. . . . .	2.00
Austen, J., <i>Works</i> , 5 Vols., Putnam [823]. . . . .	2.50
Blackmore, <i>Lorna Doone</i> , Ginn [823]. . . . .	.65
Boswell, <i>Life of Johnson</i> , 2 Vols., Everyman, Dutton [920]. . . . .	.70
Browne, Sir T., <i>Religio Medici</i> and <i>Urn Burial</i> , Everyman, Dutton [240]. . . . .	.35
Browning, R., <i>Complete Works</i> , Cambridge Ed., Houghton [821]. .	3.00
Bryant, W. C., <i>Poetical Works</i> , Household Ed., Appleton [811]. .	1.50
Bunyan, J., <i>Pilgrim's Progress</i> , Everyman, Dutton [823]. . . . .	.35
Burns, R., <i>Poems, Songs and Letters</i> , Globe Ed., Macmillan [821]. . . . .	1.75
Burke, E., <i>Selected Works</i> , 3 Vols., Macmillan [825]. . . . .	3.60
Byron, Lord, <i>Poems</i> , Cambridge Ed., Houghton [821]. . . . .	3.00
Carlyle, T., <i>Heroes and Hero Worship</i> , Athen. Press, Ginn [824]. .	.80
Chaucer, G., <i>The Student's Chaucer</i> , Ed. by Skeat, Macmillan [821]	1.75
Clemens, S. L. (Mark Twain), <i>Works</i> , Complete sets, 18 Vols., Harper [813]. . . . .	33.50
Coleridge, S. T., <i>Poetical Works</i> , Globe Ed., Macmillan [821]. . .	1.75
Cooper, J. F. <i>The Spy</i> and <i>The Pilot</i> , Household Ed., 2 Vols., Houghton [813]. . . . .	2.00
Cooper, J. F., <i>Leather Stocking Tales</i> , 5 Vols., Everyman, Dutton [813]. . . . .	1.75
Cowper, W., <i>Poetical Works</i> , Globe Ed., Macmillan [821]. . . . .	1.75
Defoe, D., <i>Robinson Crusoe</i> , Everyman, Dutton [823]. . . . .	.35
De Quincey, T., <i>Confessions of an English Opium Eater and Other Essays</i> , 3 Vols., Macmillan [824]. . . . .	1.50
Dickens, C., <i>Works</i> , 20 Vols., Macmillan [823]. . . . .	20.00
Dryden, J., <i>Poetical Works</i> , Globe Ed., Macmillan [821]. . . . .	1.75
or Cambridge Ed., Houghton. . . . .	3.00
Evans, Mary A., ("George Eliot"), <i>Works</i> , 12 Vols. at .90, Harper [823]. . . . .	10.80
Emerson, R. W., <i>Works</i> , 5 Vols., Bohn Lib., Bell [818]. . . . .	4.35
Goldsmith, O., <i>Miscellaneous Works</i> , Globe Ed., Macmillan [828].	1.75
Gray, T., <i>Selections</i> , Athen. Press, Ginn [821]. . . . .	.80
Harte, B., <i>Complete Poems</i> , Cabinet Ed., Houghton [811]. . . . .	1.00
Harte, B., <i>The Luck of Roaring Camp, etc.</i> , Houghton [813]. . . . .	1.00
Hawthorne, N., <i>Works</i> , 8 Vols., Popular Ed., Houghton [813]. . .	10.00
Holmes, O. W., <i>Works</i> , 14 Vols., Riverside Ed., Houghton [818]. .	21.00
Howells, W. D., <i>A Hazard of New Fortunes</i> , 2 Vols., Harper [813].	1.50
Howells, W. D., <i>The Rise of Silas Lapham</i> , Houghton [813]. . . . .	1.50
Irving, W., <i>Works</i> , 10 Vols., Crowell [818]. . . . .	10.00
Johnson, S., <i>Lives of the Poets</i> , 2 Vols., World's Classics, Oxford Press [928]. . . . .	11.00
Keats, J., <i>Poetical Works</i> , Globe Ed., Macmillan [821]. . . . .	1.75

Kingsley, C., <i>Westward Ho</i> , Macmillan [813].....	\$ 1.00
Kipling, R., <i>Works</i> , 15 Vols., Doubleday [828].....	15.00
Lamb, C., <i>Essays of Elia and Eliana</i> , Bell [824].....	1.00
Lamb, C., <i>Tales from Shakespeare</i> , Macmillan [822.33].....	1.50
Lanier, S., <i>Poems</i> , Scribner [811].....	2.00
Longfellow, H. W., <i>Complete Poetical and Dramatic Works</i> , Cambridge Ed., Houghton [811].....	2.00
Lowell, J. R., <i>Poems</i> , Household Ed., Houghton [811].....	1.50
Lowell, J. R., <i>Prose Works</i> , 7 Vols., Riverside Ed., Houghton [818]	10.50
Macaulay, T. B., <i>Critical, Historical and Miscellaneous Essays</i> , 3 Vols., Houghton [824].....	3.75
Malory, Sir T., <i>Morte D'Arthur</i> , Globe Ed., Macmillan [398]....	1.75
Macpherson, J., <i>Ossian</i> , Canterbury Poets, London, Scott [821]...	.25
Meredith, G., <i>Works</i> , 16 Vols., Scribner [823].....	24.00
Milton, J., <i>Poetical Works</i> , Ed. by Beeching, Oxford Press.....	1.10
or by Masson, Macmillan [821].....	1.75
or by Moody, Houghton.....	2.00
Poe, E. A., <i>Complete Works</i> , 17 Vols., Virginia Ed., Crowell [818]	21.00
Pope, A., <i>Poetical Works</i> , Globe Ed., Macmillan [821].....	1.75
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Historical works have not been included as it is assumed that these will be selected from the list of reference works for American History. Among the books in that list special attention is called to such collections as *Old South Leaflets*, Hill's *Liberty Documents* and Macdonald's *Select Charters and Other Documents Illustrative of American History, 1606-1898*.

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*Harrison, Benjamin, <i>This Country of Ours</i> , 1903, Scribner [342.73].	1.50
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Krause, Carl A. Articles by American writers on Modern Language Methodology for the years 1912-1913, privately printed [407].	
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Wells, <i>Drei Kleine Lustspiele</i> , (Benedix, Günstige Vorseichen; Benedix, Der Prozess; Zechmeister, Einer muss heiraten), Heath [830].....	.30
Manley and Allen, <i>Four German Comedies</i> , (Rosen, Ein Knopf; Moser, Ein amerikanisches Duell; Müller, Im Wartesalon erster Klasse; Pohl, Die Schulleiterin), Ginn [830].....	.45
Benedix, <i>Die Hochzeitsreise</i> , Heath [830].....	.25

COLLECTIONS OF GERMAN SONGS

<i>Deutsches Liederbuch für americanische Studenten</i> , (The standard work of its kind in this country), Heath [830]. . . . .	.75
Scherer und Dirks, <i>Deutsche Lieder</i> , (A good shorter collection of songs), American [830]. . . . .	.25

DICTIONARY

Dictionary, Nutt, <i>English-German Conversation Dictionary</i> , David Nutt, London [433]. . . . .	.75
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DICTIONARIES, ETC.

Convenient dictionaries, smaller and cheaper than those given above in list of reference works for school library are:

James, <i>German and English Dictionary</i> , Macmillan [433]. . .	1.50
Heath, <i>German and English Dictionary</i> , Heath [433]. . . . .	1.50
Duden, <i>Orthographisches Wörterbuch</i> , 8th Ed., Leipzig, 1911 (for spelling only) [433]. . . . .	.40

FRENCH

GENERAL REFERENCE

*Brachet-Toynbee, <i>Historical French Grammar</i> , Clarendon [445]. . . . .	\$ 2.00
*Edgren-Burnet, <i>French and English Dictionary</i> , Holt [443]. . .	1.50
*Fortier, <i>Hist. de la Littérature Française</i> , Holt [840.9]. . . . .	1.00
*Hatzfeld-Darmsteter, <i>Dictionary</i> , 2 Vols., Paris, Delagrave [443]. . . . .	8.00
* <i>International French-English Dictionary</i> (invaluable because of its having the pronunciation of all words given in phonetic spelling), Hinds & Noble [443]. . . . .	3.00
*Lanson, <i>Hist. de la Lit. Française</i> , Paris, Hachette [840.9]. . .	1.40
* <i>L'Echo des Deux Mondes</i> , a monthly journal, Chicago, A. C. Babize & Co., per year [054]. . . . .	1.50
<i>Le Maître Phonétique</i> (the best journal for the study of accurate speech, not only in French but in all the more important modern languages). Address: Rue de la Madeleine, Bourg-la-Reine, Seine, France, per year [405]. . . . .	1.40
* <i>Le Petit Larousse</i> , 1 Vol. [443]. . . . .	1.30
Matzke, <i>French Pronunciation</i> , 2d Ed., is very useful, Holt [441]. . . . .	.25
Michaëlis-Passy, <i>Dict. Phonétique Française</i> , Paris, Le Soudier [443]. . . . .	1.00
Nyrop, <i>Grammaire Historique de la Langue Française</i> , 2 Vols., 1904, Paris [445]. . . . .	3.00

*Parton, <i>French Parnassus</i> , Houghton [841].....	\$ 1.50
Passy, P., <i>Le Français Parlé</i> , Leipzig, Reisland [448].....	1.50
Passy, <i>Les Sons du Français</i> , Paris, Didot [441].....	.30
*Pellissier, <i>Précis de l'Histoire de la Lit. Française</i> [830.9]....	.80
Petit de Julleville, <i>Hist. de la Langue et de la Lit. Française</i> , 8 Vols., Paris, Armand Colin [840.9].....	25.00
Rambeau-Passy, <i>Chrestomathie Phonétique</i> , Paris, Le Soudier [441].....	1.25
<i>Revue des Deux Mondes</i> , Paris, bi-monthly, per year [054]...	12.40
*Skeat's <i>Etymological Dictionary</i> (invaluable for showing the relationship between French and English words), Claren- don [423].....	11.00

## LITERATURE

A library should, of course, contain a considerable number of standard works of French literature. There are so many of value to select from that special books or authors are not listed here.

## PHONOGRAPHS

One of the most desirable aids to a correct pronunciation is the phonograph. A teacher can not possibly give all the time necessary to secure good pronunciation in an average class, but this machine proves an admirable substitute, when conscientiously and continuously used. Good companies that sell or lease phonographs and the necessary disks for the study of a modern language are The United States School of Languages, Annapolis, Md., and the International College of Languages, Putnam Building, New York. A machine with a set of elementary disks and the corresponding text can be bought for about \$45. The set of advanced records costs \$10, and a third set of difficult French words costs \$5. The same school also has sets of records for Spanish.

## SPANISH

- \*\**Catalogue Raisonné of Spanish Literature*, (This catalog is invaluable as a guide in selecting the best works in all branches of literature and the most satisfactory periodicals). Lemcke & Buechner, New York [860]..... \$ 5.00
- \**Diccionario de la Real Academia*, Hernando, Madrid [463]....
- \*\*Fitzmaurice-Kelly, *History of Spanish Literature*, Appleton [860.9]..... 1.50
- \*\**Gramática de la Real Academia* [465]..... 1.75
- \*\*Handschin, *The Teaching of Modern Languages in the United States*, U. S. Bureau of Education, Washington, D. C. [407] Free.
- \*Hume, *Modern Spain*, Unwins, London [946]..... 1.25



*Hume, <i>Spanish Influence on English Literature</i> , Nash, London [820.9].....	\$ 2.00
*Menéndez y Pelayo, <i>Las Cien Mejores Poesías</i> , Victoriano Suárez, Madrid [860].....	.35
**Pequeño Larousse ilustrado, Librería Larousse, Paris [443]..	1.80
**Ramsey, <i>Text-Book of Modern Spanish</i> , Holt, New York [468].....	1.80
**Velásquez, <i>Diccionario Esp.-Ingles</i> , Appleton, New York [463].....	6.00

A language-'phone equipment for supplementary practice in hearing the language is strongly recommended. The International College of Languages, New York, is one of the houses dealing in supplies of this nature.

### PHYSICS

Aryton, W. E., <i>Practical Electricity</i> , 1900, Cassell [537].....	\$ 2.00
Boys, C. V., <i>Soap Bubbles</i> , 1900, London, S. P. C. K. [532]..	.50
*Cajori, F. F., <i>History of Physics</i> , 1899, Macmillan [530.9]...	1.60
*Derr, <i>Photography for Students of Physics and Chemistry</i> , Macmillan [535.8].....	1.40
Duff, A. W., <i>Text-book of Physics</i> , 1912, Blakiston [530].....	2.75
Edser, E., <i>Light for Students</i> , 1903, Macmillan [535].....	1.50
*Edser, E., <i>Heat for Advanced Students</i> , 1901, Macmillan [536]	1.00
Everett, J. D., <i>C. G. S. System of Units</i> , 1891, Macmillan [531]	1.25
Forbes, G., <i>Course of Lectures on Electricity</i> , 1888, London, Longmans [537].....	1.00
Glazebrook, R. T., <i>Mechanics and Hydrostatics</i> , Macmillan [541].....	2.50
Guthe, <i>Definitions in Physics</i> , Macmillan [530].....	.75
Hastings, <i>Light</i> , Scribner [535].....	2.50
*Houston and Kennelly, <i>Elementary Electrical Series</i> , 10 Vols., Magnetism, The Electric Motor, The Electric Telegraph, The Electric Telephone, Electric Street Railways, etc., New York, McGraw and Hill, per volume [621.3].....	1.00
Larden, W., <i>Electricity</i> , Longmans [537].....	1.75
Maxwell, J. C., <i>Theory of Heat</i> , 1897, London, Longmans [536.1].....	1.50
Michelson, <i>Light Waves and their Uses</i> , University of Chicago Press [535.4].....	2.00
Miller, D. C., <i>Laboratory Physics</i> , 1903, Ginn [530].....	2.00
Nichols, E. L., <i>Laboratory Manual of Physics</i> , Vol. 1, Macmillan [530.7].....	3.00
Perry, J., <i>Spinning Tops</i> , 1901, London, S. P. C. K. [531]..	.50
Poyser, A. W., <i>Magnetism and Electricity</i> , Longmans [537]..	1.50
**Smithsonian, <i>Physical Tables</i> , Smithsonian Institute [531.9].	2.00
**Spinney, <i>A Textbook in Physics</i> , Macmillan [530].....	2.75

Stewart, B., and Gee, W. W., <i>Lessons in Elementary Practical Physics</i> , Vol. 1 1898, Macmillan [530.7].....	\$ 1.50
Taylor, Sedley, <i>Sound and Music</i> , London, Macmillan [534.3]	2.25
*Thomson, J. J., <i>Electricity and Matter</i> , 1904, Scribner [537.1]	1.25
*Thompson, S. P., <i>Elementary Lessons in Electricity and Magnetism</i> , 1892, Macmillan [537].....	1.40
Thompson, S. P., <i>Light, Visible and Invisible</i> , 1897, Macmillan [535].....	1.50
Thompson, S. P., <i>Michael Faraday</i> , Cassell & Co. [920]....	1.25
**Tyndall, J., <i>Heat as a Mode of Motion</i> , 1895, Appleton [536.1]	2.50
**Tyndall, J., <i>Sound</i> , 1895, Longmans [534].....	2.00
*Watson, W., <i>Text-book on Physics</i> , Longmans [530].....	3.50
Wood, R. W., <i>Physical Optics</i> , 1905, Macmillan [535].....	3.50
*Wright, L., <i>Optical Projection</i> , Longmans [535].....	2.25
*Zahn, J. A., <i>Sound and Music</i> , 1892, McClurg [534].....	3.00

### CHEMISTRY

Armitage, F. A., <i>History of Chemistry</i> , 1906, Longmans [540]§	1.60
*Bailey, E. H. S., <i>Chemistry: Sources of Foods</i> , Blakiston [641]	1.60
Bailey, E. H. S., <i>Sanitary and Applied Chemistry</i> , 1906, Macmillan [540].....	1.40
*Bird, R. M., <i>Modern Science Reader</i> , Macmillan [500].....	1.10
*Blanchard and Wade, <i>Foundations of Chemistry</i> , American [540].....	1.25
**Cook, C. G., <i>A Practical Chemistry for High School Students</i> , Appleton [540].....	1.25
*Dobbin, L., and Walker, J., <i>Chemical Theory for Beginners</i> , Macmillan [540].....	.70
Duncan, R. K., <i>The Chemistry of Commerce</i> , 1907, Harper [540].....	2.00
**Faraday, M., <i>Chemical History of a Candle</i> , Harper [541.3]..	.85
*Frary, <i>Manual of Glass Blowing</i> , McGraw [540].....	.75
Holleman, A., <i>Organic Chemistry</i> , Wiley [547].....	2.50
**Kahlenberg and Hart, <i>Chemistry and Daily Life</i> , Macmillan [540].....	1.25
Lassar-Cohn, <i>Chemistry in Daily Life</i> , Lippincott [660.4]....	1.50
Meyer, E. von, <i>History of Chemistry</i> , 1898, Macmillan [540.9]	4.50 *
*Newth, G. S., <i>Text-book of Inorganic Chemistry</i> , 1894, Longmans [546].....	1.75
Olsen, <i>Quantitative Analysis</i> , Van Ostrand [545].....	4.00
*Ostwald, W., <i>Conversations in Chemistry</i> , 1905, N. Y., Wiley, [540].....	1.50
**Philip, <i>The Romance of Modern Chemistry</i> , Lippincott [540]	1.50
*Picton, H. W., <i>Story of Chemistry</i> , 1892, London, Isbister [540].....	.85

*Ramsay, W., <i>Gases of the Atmosphere</i> , 1896, Macmillan [540.9]S	1.50
*Reychler, A., <i>Outlines of Physical Chemistry</i> , Macmillan [541.1].....	1.00
*Roscoe, H. E., <i>Life and Experiences</i> , 1906, Macmillan.....	4.00
*Shenstone, <i>The Methods of Glass Blowing</i> , Longmans [540]..	1.50
**Smith, A., <i>General Inorganic Chemistry</i> , 1906, Century [546].	2.25
Snyder, H., <i>Chemistry of Plant and Animal Life</i> , 1903, Macmillan [540].....	1.40
Snyder, H., <i>Chemistry of Soils and Fertilizers</i> , 1899, Easton, Chemical Pub. [631.2].....	1.50
*Sutton, <i>Volumetric Analysis</i> , Blakiston [545.6].....	5.50
**Thompson, S. P., <i>Michael Faraday: Life and Work</i> , 1898, Macmillan [920].....	1.25
*Thorpe, T. E., <i>Essays in Historical Chemistry</i> , Macmillan [925.4].....	4.00
*Treadwell-Hall, Vol. I, <i>Qualitative Analysis</i> , Wiley [544]....	3.00
Treadwell-Hall, Vol. II, <i>Quantitative Analysis</i> , Wiley [545]...	4.00
The laboratory manuals of Allyn, Miss Blanchard, Vulté, and Snell on Household and Applied Chemistry will afford suggestions for supplementary experiments that may be assigned to the more rapid workers in the class.	

## GENERAL BIOLOGY, BOTANY AND ZOOLOGY

### GENERAL BIOLOGICAL REFERENCES

**Abbott, J. F., <i>General Biology</i> , Macmillan [570].....S	1.50
Bigelow, M. A., <i>Applied Biology</i> , 1911, Macmillan [570]....	1.40
Bower, F. O., <i>The Origin of a Land Flora</i> , 1908, Macmillan [580].....	5.50
**Hodge, C. F., <i>Nature Study and Life</i> , 1902, Ginn [570.7]....	1.50
**Hunter, G. W., <i>Elements of Biology</i> , American [570].....	1.25
**Hunter, G. W., <i>Essentials of Biology</i> , American [570].....	1.25
*Hunter, G. W., <i>A Civic Biology</i> , 1914, American [570].....	1.25
Marshall, C. E., <i>Microbiology</i> , 1912, Blakiston [589.9].....	2.50
**Needham, J. G., <i>General Biology</i> , 1910, Comstock [570]....	2.60
Kerner, A., von M., <i>Natural History of Plants</i> , Tr. by F. W. Oliver, 2 Vols., 1895, Holt [581].....	15.00
*Parker, T. J., <i>Elementary Biology</i> , Macmillan [570].....	2.60
*Sedgwick, W. T., and Wilson, E. B., <i>General Biology</i> , 2d Ed., 1895, Holt [570].....	1.75
Smallwood, W. M., <i>A Text-Book of Biology</i> , 1913, Lea [570].	2.75
Thomson, J. A., <i>The Story of Animal Life</i> , Scribner [590]....	1.50
Thomson, J. A., <i>The Science of Life</i> , 1899, Stone [570].....	1.75

The teacher should have access to the following:

Brode, H. S., <i>Books on Biology for Boys and Girls</i> , Whitman [570]. College Quarterly, Vol. 17, No. 2, Walla Walla, Washington.	
Lloyd, F. E., and Biglow, M. A., <i>The Teaching of Biology in the Secondary School</i> , 1904, Longmans [570.7].	\$ 1.50
<i>Nature-study Review: A Journal Devoted to all Phases of Nature-study in Elementary Schools</i> , 41 North Queen St., Lancaster, Pa. Per Vol. (6 nos.) [570.5].	1.00

## BOTANY

### ELEMENTARY TEXT AND REFERENCE BOOKS

Atkinson, G. F., <i>Botany for High Schools</i> , Rev. 2nd Ed., 1912, Holt [581].	\$ 1.25
Bergen, J. Y., <i>Elements of Botany</i> , Rev. Ed., 1904, Ginn [581]	1.30
Bergen, J. Y., and Caldwell, O. W., <i>Practical Botany</i> , 1911, Ginn [580].	1.30
Bergen, J. Y., and Davis, B. M., <i>Principles of Botany</i> , 1906, Ginn [580].	1.50
Buchanan, E. D. and R. E., <i>Household Bacteriology</i> , 1913, Macmillan [640].	2.25
Caldwell, O. W., <i>Handbook of Plant Morphology</i> , 1904, Holt [581.4].	1.00
Coulter, J. G., <i>Plant Life and Plant Uses</i> , 1913, American [581].	1.20
Coulter, J. M., <i>A Text-Book of Botany</i> , 1906, Appleton [581]	1.25
Coulter, J. M., <i>Plants—A Text-Book of Botany</i> , 1901, Appleton [581].	1.25
**Coulter, J. M., Barnes, C. R., and Cowles, H. C., <i>A Text-Book of Botany</i> , 1910, American [581].	3.50
Curtis, C. C., <i>Nature and Development of Plants</i> , Rev. 3d Ed., 1914, Holt [581].	2.50
**Duggar, B. M., <i>Fungous Diseases of Plants</i> , 1909, Ginn [581.2]	2.00
**Duggar, B. M., <i>Plant Physiology</i> , 1911, Macmillan [581].	1.50
Ganong, W. F., <i>A laboratory course in Plant Physiology</i> , 1908, Holt [581].	1.75
**Ganong, W. F., <i>The Living Plant</i> , 1913, Holt [581].	3.50
Leavitt, R. G., <i>Outlines of Botany</i> , 1901, American [580].	1.00
**Lipman, J. G., <i>Bacteria in Relation to Country Life</i> , 2nd Ed., 1909, Macmillan [589.9].	1.50
Peirce, G. J., <i>A Text-Book of Plant Physiology</i> , 1903, Holt [581.1].	2.00
Pinchot, G., <i>A Primer of Forestry</i> , Bul. 24, Bureau of Forestry,	

Wash. [634.9].....	
**Robinson, B. L., and Fernald, <i>Gray's New Manual of Botany</i> , 7th Ed., 1908, American [581].....	\$ 2.50
Sargent, F. L., <i>Plants and Their Uses</i> , 1913, Holt [581].....	.75
*Schimper, A. F. W., <i>Plant Geography</i> , Tr. by Fischer, 1903, Oxford Press [581.9].....	12.75
*Strasburger, E., Schenck, H., Jost, L., and Karsten, G., <i>A Text-Book of Botany</i> , 4th Eng. Ed., Tr. by W. H. Lang, 1912, Macmillan [581].....	5.00
Stevens, F. L., <i>The Fungi which Cause Plant Disease</i> , 1913, Macmillan [589.9].....	4.00

ADDITIONAL TEXTS, FLORAS, AND APPLIED WORKS

The following should be added to the above list, if possible:

Andrews, E. F., <i>Botany All the Year Round</i> , 1903, American [581].....	1.00
Atkinson, G. F., <i>College Botany</i> , 1905, Holt [581].....	2.00
Atkinson, G. F., <i>Studies of American Fungi: Mushrooms—Edible, Poisonous, etc.</i> , 1900, Ithaca, Andrus & Church [589.2].....	3.00
Bailey, L. H., <i>Survival of the Unlike</i> , 1896, Holt [581.15]...	2.00
Bailey, L. H., <i>Plant Breeding</i> , 1906, Macmillan [716].....	1.00
Bergen, J. Y., <i>Foundations of Botany</i> , Ginn [581].....	1.50
*Britton, N. L., <i>N. A. Trees</i> , 1908, Holt [634.9].....	7.00
Campbell, D. H., <i>Mosses and Ferns</i> , 1905, Macmillan [587].....	4.00
deCandolle, <i>Origin of Cultivated Plants</i> , 1906, Appleton [581.6].....	2.00
Chamberlain, D. J., <i>Methods in Plant Histology</i> , 2nd Ed., 1905, Chicago University Press [581.8].....	2.25
Conn, H. W., <i>Agricultural Bacteriology</i> , 2nd Ed., 1910, Philadelphia, Blakiston [589.85].....	2.50
Darwin, C., <i>Insectivorous Plants</i> , 1892, Appleton [581.53]...	2.00
Darwin, C., <i>Power of Movement in Plants</i> , 1892, Appleton [581.47].....	2.00
Darwin, C., <i>Cross and Self Fertilization in the Vegetable Kingdom</i> , 1895, Appleton [581.16].....	2.00
<i>Farmers' Bulletins</i> , U. S. Dept. of Agr., Washington, D. C., [630] free.	
Gifford, J., <i>Practical Forestry</i> , 1902, Appleton [634.9].....	1.20
Hard, M. A., <i>Mushrooms</i> , 1908, Kirkwood, Mo., Author [589.2].....	4.75
*Jordan, E. O., <i>A Text-book of General Bacteriology</i> , 4th Ed., 1914, Saunders [589.9].....	3.00
Lubbock, J., <i>Flowers, Fruits and Leaves</i> , 1886, Macmillan [581].....	1.25
Stevens, W. C., <i>Introduction to Botany</i> , 1906, Heath [581]...	1.50

Stevens, W. C., <i>Plant Anatomy</i> , 2nd Ed., Rev., 1910, Blakiston [581.4].....	S 2.00
Stevens, F. L., and Hall, J. G., <i>Diseases of Economic Plants</i> , 1910, Macmillan [581.2].....	1.50
Underwood, L. M., <i>Our Native Ferns and Their Allies</i> , 1900, Holt [587].....	1.00
Underwood, L. M., <i>Moulds, Mildews and Mushrooms</i> , 1899, Holt [589.2].....	1.50
Many bulletins of the Bureau of Plant Industry, U. S. Dept. of Agriculture, Washington, D. C., are extremely valuable in high school work and should be obtained when possible.	

## ZOOLOGY

## ELEMENTARY TEXTS AND REFERENCE BOOKS

Hegner, R. W., <i>College Zoology</i> , 1912, Macmillan [590].....	S 2.60
Hegner, R. W., <i>Introduction to Zoology</i> , 1910, Macmillan [590]	1.90
Hertwig, R., <i>General Principles of Zoology</i> , 1897, Holt [590].	1.60
Hertwig, R., Ed. by J. S. Kingsley, <i>A Manual of Zoology</i> , 1912, Holt [590].....	3.00
*Holmes, S. J., <i>The Biology of the Frog</i> , 1906, Macmillan [597.8]	1.60
Hornaday, W. T., <i>Taxidermy and Zoological Collecting</i> , 1891, Scribner [579].....	2.50
**Hough, T., and Sedgwick, W. T., <i>The Human Mechanism</i> , Ginn [612].....	2.40
Jordan, D. S., and Kellogg, V. S., <i>Animal Life: A First Book of Zoology</i> , 1900, Appleton [591].....	1.20
Jordan, D. S., and Heath, H., <i>Animal Forms: A Second Book of Zoology</i> , 1902, Appleton [591].....	1.20
**Jordan, D. S., Kellogg, V. L., and Heath, H., <i>Animals</i> (consisting of <i>Animal Life</i> and <i>Animal Forms</i> bound in one volume), 1903, Appleton [591].....	1.80
Jordan, D. S., Kellogg, V. L., and Heath, H., <i>Animal Studies: A Text-book of Elementary Zoology</i> , 1903, Appleton [591]	1.25
Jordan, D. S., and Price, G. C., <i>Animal Structures: A Laboratory Guide Designed to Accompany Animal Studies</i> , 1903, Appleton [591].....	.50
**Linville, H. R., and Kelly, H. A., <i>A Text-book in General Zoology</i> , 1906, Ginn [591].....	1.50
Osburn, R. C., <i>The Care of Home Aquaria</i> , N. Y. Aquarium Nature Series, Published by N. Y. Zoological Society [590.7]	
**Parker, T. J., and Haswell, W. A., <i>A Text-book of Zoology</i> , 2 Vols., 1910, Macmillan [591].....	9.00
*Parker, T. J. and W. N., <i>Practical Zoology</i> , 1908, Comstock [591].....	2.60

BOOKS ON SPECIAL SUBJECTS

Invertebrates

*Benton, F., <i>Honey Bee</i> , U. S. Dept. of Agriculture, Division of Entomology, New Ser., Bulletin No. 1 [638].....S	15
Brooks, W. K., <i>The Oyster</i> , 1905, Johns Hopkins Press [594.1]	1.00
**Comstock, J. H., <i>Insect Life</i> , New Ed., Comstock [595.7]...	1.75
Comstock, J. H., <i>Manual for the Study of Insects</i> , 1909, Comstock [595.7].....	3.75
Darwin, C., <i>The Formation of Vegetable Mould</i> , 1892, Appleton [591.1].....	1.50
Emerton, J. H., <i>Spiders, Their Structure and Habits</i> , 1890, Whidden [595.4].....	1.50
Folsom, J. W., <i>Entomology with Special Reference to its Biological and Economic Aspects</i> , 1906, Blakiston [595.7]...	3.00
Holland, W. J., <i>The Butterfly Book</i> , 1899, Doubleday [595.78]	3.00
Holland, W. J., <i>The Moth Book</i> , 1903, Doubleday [595.78]..	4.00
Howard, L. O., <i>The Insect Book</i> , 1902, Doubleday [595.7]...	3.00
Howard, L. O., <i>Mosquitoes</i> , 1901, McClure [595.77].....	1.50
Huxley, T. H., <i>The Crayfish</i> , 1895, Appleton [595.3].....	1.75
*Kellogg, V. L., <i>American Insects</i> , 1905, Holt [595.7].....	5.00
*Miall, L. C., <i>Natural History of Aquatic Insects</i> , 1895, Macmillan [595.7].....	1.75
*Peckham, G. W. and E. G., <i>Wasps, Social and Solitary</i> , 1905, Houghton [595.79].....	1.50
*Sanderson and Jackson, <i>Elementary Entomology</i> , 1912, Ginn [595.7].....	2.00

Vertebrates

*Bailey, F. M., <i>Handbook of Birds of the Western United States</i> , 1902, Houghton [598.2].....	3.50
Blanchan, N., <i>Birds that Hunt and Are Hunted</i> , 1898, N. Y., Doubleday [598.2].....	2.00
**Chapman, F. M., <i>Color Key to North American Birds</i> , 1903, Doubleday [598.2].....	2.50
**Chapman, F. M., <i>Bird Life: A Guide to the Study of our Common Birds</i> , 1897, Appleton, Without colored plates....	1.75
With colored plates [598.2].....	5.00
Coward, T. A., <i>The Migration of Birds</i> , 1912, Cambridge University Press [598.2].....	.40
Dugmore, A. R., <i>Bird Homes</i> , 1900, Doubleday [598.2].....	2.00
Jordan, D. S., <i>A Guide to the Study of Fishes</i> , 1905, Holt [597]	12.00
*Jordan, D. S., <i>Manual of the Vertebrates of the Northern United States</i> , 9th Ed., 1900, McClurg [596].....	2.50
Jordan, D. S., and Evermann, B. W., <i>American Food and</i>	

<i>Game Fishes</i> , 1902, Doubleday [597].....	\$ 4.00
*Kellicott, W. E., <i>Chordate Development</i> , 1913, Holt [591.3]...	2.50
*Kingsley, J. S., <i>Comparative Anatomy of Vertebrates</i> , 1912, Blakiston [591.4].....	2.25
*Lankester, E. R., <i>Extinct Animals</i> , 1905, Holt [560] .....	1.75
Reed, C. A., <i>North American Birds' Eggs</i> , 1904, Doubleday [598.2].....	2.50
Stone, W., and Cram, W. E., <i>American Animals</i> , 1902, Doubleday [591.9].....	3.00

### Evolution and Heredity

Bateson, W., <i>Mendel's Principles of Heredity</i> , Putnam [575.1]	3.50
**Crampton, H. E., <i>The Doctrine of Evolution</i> , 1911, Columbia University Press [575].....	1.50
Darbishire, A. D., <i>Breeding and the Mendelian Discovery</i> , 1912, Cassell [575.1].....	2.00
Darwin, Charles, <i>The Origin of Species</i> , Appleton [575.8]...	2.00
Darwin, Charles, <i>Animals and Plants under Domestication</i> , Appleton [575.3].....	5.00
Davenport, E., <i>Principles of Breeding</i> , 1908, Ginn [575.6]...	2.50
Dendy, A., <i>Outlines of Evolutionary Biology</i> , 1912, Appleton [575].....	3.50
Doncaster, L., <i>Heredity in the Light of Recent Research</i> , 1912, Cambridge University Press [575.1].....	1.00
*Herbert, S., <i>First Principles of Heredity</i> , A. C. Black, London [575].....	1.25
Holmes, S. J., <i>The Evolution of Animal Intelligence</i> , 1911, Holt [591.5].....	2.75
**Jordan, D. S., and Kellogg, V. L., <i>Evolution and Animal Life</i> , 1907, Appleton [591.5].....	2.50
**Kellicott, W. E., <i>The Social Direction of Human Evolution</i> , 1911, Appleton [575.6].....	1.50
Lucas, F. A., <i>Animals of the Past</i> , 1901, Doubleday [560]...	2.00
Punnett, R. C., <i>Mendelism</i> , 1911, Macmillan [575.1].....	1.25
Romanes, G. J., <i>Darwin and After Darwin: I. The Darwinian Theory</i> , 1910, Open Court [575].....	4.00
**Walter, H. E., <i>Genetics, An Introduction to the Study of Heredity</i> , 1913, Macmillan [612.6].....	1.50

### PHYSIOLOGY

#### ELEMENTARY TEXT AND REFERENCE BOOKS

*Budgett, <i>Essentials of Physiology</i> , Saunders [612].....	\$ 1.00
*Colton, <i>Physiology, Experimental and Descriptive</i> , Heath [612]	1.15
Eddy, <i>General Physiology and Anatomy</i> , American [612]....	1.20



Fitz, <i>Physiology and Hygiene</i> , Holt [613].....	\$ 1.12
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V. Jewett, <i>Control of Body and Mind</i> [130].....	.50
Hewes, <i>High School Physiology</i> , American [612].....	1.00
**Hough and Sedgwick, <i>The Human Mechanism</i> , Ginn [612]...	2.00
**Huxley, <i>Lessons in Elementary Physiology</i> , Ed. by Lee, Macmillan [612].....	1.40
Jones and Stephens, <i>Outlines of Physiology</i> , Phila., Blakiston [612].....	1.50
Krohn, <i>Graded Lessons in Hygiene</i> , Appleton [613].....	.60
Martin, <i>The Human Body</i> , (Advanced course), Holt [612] ..	2.50
Walters, <i>Physiology and Hygiene</i> , Heath [613].....	1.20

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Beddard, Edkins, Flack, Hill, MacLeod, and Pembrey, <i>Practical Physiology</i> , Longmans [612].....	4.00
**Gorham and Tower, <i>Dissection of the Cat</i> , Scribner [591]....	.90
*Hawk, <i>Practical Physiological Chemistry</i> , Phila., Blakiston [612].....	2.50
Lombard, <i>Laboratory Work in Physiology</i> , Ann Arbor, Mich., Geo. Wahr [612].....	1.50
*Stirling, <i>Outlines of Practical Physiology</i> , Phila., Blakiston [612].....	2.00

## ADVANCED TEXTS AND REFERENCE BOOKS

Gerrish, <i>Text-book of Anatomy</i> , Phila., Lea Bros. [611].....	6.50
*Greene, <i>Kirke's Handbook of Physiology</i> , With Laboratory Outlines, N. Y., Wm. Wood [612].....	3.00
*Greene, <i>Handbook of Pharmacology</i> , N. Y., Wm. Wood [615]	3.50
Hall, <i>Text-book of Physiology</i> , Phila., Lee Bros. [612].....	4.00
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Sollman, <i>Text-book of Pharmacology</i> , Saunders [615].....	4.00
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Ball, <i>Starland</i> , Ginn [520].....	\$ 1.00
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*Bowman, <i>South America</i> , (A geographical reader) [918]....	.75
**Brigham, <i>Geographic Influences in American History</i> , Ginn [973].....	1.00
**Dodge, <i>A Reader in Physical Geography</i> , Longmans [551.4]..	.70
Drummond, <i>Tropical Africa</i> , Scribner [916].....	1.00
Emerson, <i>Geography of Missouri</i> . Educational Series, Vol. I, No. 4, University of Missouri, Columbia, Missouri [551.4]. Free.	
**Fairbank, <i>Practical Physiography</i> , Allyn [551.4].....	1.50
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Johnson, <i>Along French Byways</i> , Macmillan [914.4].....	2.00
Johnson, <i>The Isle of Shamrock</i> , Macmillan [914.15].....	2.00
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*Kent, <i>Biblical Geography and History</i> , Scribner [220.9]....	1.50
Knox, <i>Japanese Life in Town and Country</i> , Putnam [915.2]..	1.20
Longman, <i>School Atlas</i> , Longmans [912].....	1.30
Marbut, <i>The Physical Features of Missouri</i> , Report of Missouri Geological Survey, Vol. X, 1896, Dir. of State Bureau of Geology and Mines, [551.4] Free.	
MacKinder, <i>Britain and the British Seas</i> , Appleton [914.2]..	3.50
*McMurry, <i>Larger Type Studies in Geography</i> , Macmillan [910]	.75
Mill, <i>International Geography</i> , Appleton [910].....	3.00
** <i>Physiography of the United States</i> , various authors, American [551.4].....	1.50
**Pirsson, <i>Rocks and Rock Minerals</i> , Wiley [552].....	2.50
Porter, <i>The Ten Republics</i> (South America), Rand [918]....	1.00
*Russell, <i>Glaciers of North America</i> , Ginn [551.3].....	1.75
*Russell, <i>Lakes of North America</i> , Ginn [551.4].....	1.50
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**Todd, <i>New Astronomy</i> , American [520].....	1.30
**Ward, <i>Climate</i> , Putnam [551.5].....	2.00
Ward, <i>Practical Exercises in Elementary Meteorology</i> , Ginn [551.5].....	1.12
**Salisbury and Atwood, <i>Interpretation of Topographic Maps</i> , Supt. of Documents, Washington, D. C. [912].....	2.75
(Copies for free distribution exhausted, but Senator or Representative may be able to supply copies. Send to Supt. of Documents, Washington, D. C., for Price List 15, Geological Survey Publications, and 35, Geography and Exploration.)	

# AGRICULTURE

*Baily, <i>Cyclopedia of American Agriculture</i> , 4 Vols., Macmillan [630].....	\$ 20.00
Bailey, <i>Farm Buildings</i> , Sanders Pub. Co., Chicago [728]....	2.00
**Bailey, <i>Fruit Growing</i> , Macmillan [634].....	1.50
*Bailey, <i>Insect Pests of Farm, Orchard and Garden</i> , Wiley [632]	3.00
**Bailey, <i>Plant Breeding</i> , Macmillan [581].....	1.25
*Bailey, <i>Vegetable Gardening</i> , Macmillan [635].....	1.50
**Bowman and Crossley, <i>Corn</i> , Bowman and Crossley, Ames, Ia. [633].....	2.50
**Brigham, <i>Progressive Poultry Culture</i> , Torch Press [636.5]...	1.30
**Burkett, <i>Soils</i> , Judd [631].....	1.00
Corbett, <i>Garden Farming</i> , Ginn [635].....	2.00
**Day, <i>Productive Swine Husbandry</i> , Lippincott [636.4].....	1.50
Davidson, <i>Agricultural Engineering</i> , Webb. Pub. Co. [630]..	1.50
*Duggar, <i>Diseases of Plants</i> , Ginn [581.2].....	2.00
*Harper, <i>Animal Husbandry for Schools</i> , Macmillan [636]....	1.40
**Henry, <i>Feeds and Feeding</i> , W. A. Henry, Madison, Wis, [630]	2.25
**Hunt, <i>Forage and Fibre Crops</i> [633].....	1.75
**King, <i>The Soil</i> , Macmillan [631].....	1.50
Livingston, <i>Field Crop Production</i> [633].....	1.40
**Lyon and Fippin, <i>Principles of Soil Management</i> , Macmillan [631].....	1.75
**Mumford, <i>Beef Production</i> , H. W. Mumford, Urbana, Ill. [636.2].....	1.50
*O'Kane, <i>Injurious Insects</i> , Macmillan [632].....	2.00
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*Pammel, <i>Weeds of the Farm and Garden</i> , Judd [632].....	1.50
**Plumb, <i>Beginnings in Animal Husbandry</i> , Ginn [636].....	1.25

**Powell, <i>Co-operation in Agriculture</i> , Macmillan [630].....	S 1.50
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**Vivian, <i>First Principles of Soil Fertility</i> , Judd [631].....	1.00
Voorhees, <i>Fertilizers</i> , Macmillan [631].....	1.25
**Warren, <i>Farm Management</i> , Macmillan [630].....	1.75
*Watts, <i>Vegetable Gardening</i> , [635].....	1.75
Wheeler, <i>Manures and Fertilizers</i> , Macmillan [631].....	1.60
Wilson & Warburton, <i>Field Crops</i> [633].....	1.50
**Wilson, <i>Evolution of a Country Community</i> , The Pilgrim Press [630].....	1.25
Whitson and Woolster, <i>Soils and Soil Fertility</i> , Webb Pub. Co. [631].....	1.25
**At least one good farm paper.....	1.00
For additional books on agriculture see the <i>Course of Study in Agri- culture</i> , published by State Department of Education, 1913.	

## TEXT BOOKS

It is believed that better work will be done if the teacher will use a number of good texts. If four or five copies of each of the following books are purchased, it will be unnecessary for the students to purchase any textbook.

Ferguson, <i>Elementary Principles of Agriculture</i> , Ferguson [630].....	\$ 1.00
Goodrich, <i>First Book of Farming</i> , Doubleday [630.].....	1.00
Halligan, <i>The Fundamentals of Agriculture</i> , Heath [630]....	1.20
Jackson and Daugherty, <i>Agriculture</i> , Judd [630].....	1.50
Mayne and Hatch, <i>High School Agriculture</i> , American [630].	1.00
Warren, <i>Elements of Agriculture</i> , Macmillan [630].....	1.10

## LABORATORY MANUALS

It will be necessary for each student to purchase a manual for his own use. The manuals named below are among the best published.

Call and Schafer, <i>A Laboratory Manual of Agriculture</i> , Mac- millan [630.7].....	S .92
Elliff, <i>A Unit in Agriculture</i> , Row [630.7].....	.50

## DRAWING

## BOOKS

**Bailey, H. T., <i>Art Education</i> , Houghton [707].....	S .60
*Batchelder, E. A., <i>Principles of Design</i> , 1904, Chicago, In- land Printer [745].....	3.00

*Batchelder, E. A., <i>Design in Theory and Practice</i> , Macmillan [745].	\$ 1.75
**Bennett, C. A., <i>Problems in Mechanical Drawing</i> , Manual Arts Press, Peoria [744].	1.00
*Brown, G., Baldwin, <i>The Fine Arts</i> , Scribner [701].	1.25
*De Garmo, <i>Art Appreciation</i> , Syracuse, N. Y., C. W. Bardeen [701].	.40
*Dow, A. W., <i>Composition</i> , N. Y., 7th Ed., Doubleday [741].	3.50
Duval, M., <i>Artistic Anatomy</i> , N. Y., Cassell [743].	2.50
Edminster, C. F., <i>Architectural Drawing</i> , N. Y., Williams [744].	2.00
**French, Thos. E., <i>Engineering Drawing</i> , McGraw-Hill Book Co., N. Y. [744].	2.00
**French & Meiklejohn, <i>Essentials of Lettering</i> , McGraw-Hill Book Co., New York City [745].	1.00
*Froehlich, H. B., and Snow, B. E., <i>Art Education for High Schools</i> 1908, N. Y., Prang [707].	1.25
**Griffith, Ira S., <i>Correlated Courses in Woodwork and Mechanical Drawing</i> , Manual Arts Press, Peoria [744].	1.50
Holme, C., ed., <i>Modern Pen Drawing</i> , N. Y., Lane [741].	4.00
**Johnston, Edward, <i>Writing, Illuminating and Lettering</i> , London, John Hogg [745].	2.12
**La Farge, John, <i>Great Masters</i> , McClure, Phillips [759].	2.50
Lilley, A. E. V., and Midgley, W., <i>Book of Studies in Plant Form</i> , Scribner [745].	2.00
Longfellow, W. P. P., <i>Applied Perspective</i> , Houghton [742].	3.00
**Maginnis, C. D., <i>Pen Drawing</i> , Bost., Bates and Guild [741]	1.00
**Miller, L. W., <i>Essentials of Perspective</i> , Scribner [742].	1.50
Morris, I. H., <i>Geometrical Drawing for Art Students</i> , London, Longmans [744].	.60
Mumford, J. K., <i>Oriental Rugs</i> , Scribner [745.2].	7.50
Partridge, W. O., <i>Technique of Sculpture</i> , Ginn [730].	1.00
*Poore, Henry, <i>Pictorial Composition</i> , Baker, Taylor [750].	1.50
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**Reinach, Solomon, <i>Apollo or the Story of Art Throughout the Ages</i> , Scribner [709].	1.50
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*Robinson, <i>Principles of Architectural Composition</i> , Arch. Record Co. [729].	2.50
**Ross, D. W., <i>On Drawing and Painting</i> , Houghton [745].	2.50
*Ross, D. W., and others, <i>Illustrations of Balance and Rhythm</i> , Boston, Clarke [745].	3.00
*Ross, D. W., <i>Theory of Pure Design</i> , Houghton [745].	2.50
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*Western Drawing and Manual Training Association, <i>Annual Reports</i> , C. S. Van Deusen, Kent, Ohio [740].....	1.00
*Woodbury, C. H., <i>Pencil Studies</i> , Boston, Prang [741].....	1.50

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** <i>School Arts Magazine</i> , monthly, Boston School Arts Pub. Co., per year [705].....	1.50
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<i>The International Studio</i> , monthly, N. Y., John Lane, per year [705].....	5.00

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Crawshaw, F. D., <i>Problems in Furniture Making</i> , Peoria, Manual Arts Press [680].....	\$ 1.00
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Griffith, Ira S., <i>Correlated Courses in Woodwork and Mechan- ical Drawing</i> , Peoria, Manual Arts Press [680].....	1.50
Murray, M. W., <i>Problems in Woodworking</i> , Peoria, Manual Arts Press [680].....	.75
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<i>Manual Training and Vocational Education</i> , Peoria, Ill. [605]	2.00

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Leach, <i>Food Analysis and Inspection</i> , Wiley [543.1].....	7.50
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- No. 29. *Souring of Milk.*
- No. 34. *Composition and Cooking of Meat.*
- No. 36. *Cotton Seed and Its Products.*
- No. 42. *Facts about Milk.*
- No. 62. *Pure Cultures of Bacteria for Cheese Making.*
- No. 63. *Care of Milk on the Farm.*
- No. 73. *Pure Water; Cooking Vegetables.*
- No. 84. *Potatoes as Food.*
- No. 85. *Fish as Food.*
- No. 87. *Food Value of Eggs.*
- No. 93. *Sugar as Food.*
- No. 103. *Preserving Eggs.*
- No. 105. *Cereal Breakfast Food.*
- No. 112. *Bread and Bread Making.*
- No. 114. *Skim Milk in Bread Making.*
- No. 119. *Banana Flour.*
- No. 121. *Beans, Peas and Other Legumes as Foods.*
- No. 122. *Selling Eggs by Weight; Flavor of Eggs; Nuts as Food; Coffee Substitutes.*
- No. 124. *Distilling Drinking Water.*
- No. 131. *Household Tests for the Detection of Oleomargarine and Renovated Butter.*
- No. 135. *Sorghum Syrup Manufacture.*
- No. 144. *Curing Cheese.*
- No. 162. *Cooking of Meat.*
- No. 166. *Cheese Making on the Farm.*
- No. 169. *Food Value of Beans.*
- No. 175. *Home Manufacture and Use of Unfermented Grape Juice.*
- No. 183. *Meat on the Farm, Butchering, Curing, Keeping.*
- No. 186. *Curing Cheese in Cold Storage, Keeping Quality of Butter.*
- No. 190. *Cost of Eggs in Winter.*



- No. 193. *Bread and Toast; Cooking Meat.*
  - No. 202. *Manufacture of Cottage Cheese.*
  - No. 203. *Canning of Fruits, Preserves and Jellies.*
  - No. 237. *Cereal Breakfast Foods; Swiss Cheese.*
  - No. 241. *Butter Making on the Farm.*
  - No. 244. *Cooking Quality of Potatoes; Food Value of Cottage Cheese.*
  - No. 249. *Cereal Breakfast Foods.*
  - No. 256. *Preparation of Vegetables for the Table.*
  - No. 262. *Water for Table Use.*
  - No. 281. *Corn as Food for Man.*
  - No. 295. *Potatoes and other Root Crops as Food.*
  - No. 298. *The Fireless Cooker; Food Value of Corn and Corn Products.*
  - No. 305. *Gluten Flours.*
  - No. 309. *Ice for Household Use.*
  - No. 316. *Cooking Cereal Foods.*
  - No. 326. *Macaroni Wheat.*
  - No. 329. *Cane Sugar and Beet Sugar.*
  - No. 332. *Nuts and Their Uses as Food.*
  - No. 342. *Cooking Beans and other Vegetables in the Home.*
  - No. 348. *Bacteria in Milk.*
  - No. 353. *The Ice Box.*
  - No. 363. *Use of Milk as Food.*
  - No. 374. *Flour for Baking Powder Biscuits.*
  - No. 384. *Whipped Cream.*
  - No. 388. *Jelly and Jelly Making.*
  - No. 389. *Bread and Bread Making.*
  - No. 391. *Economical Uses of Meat in the Home.*
  - No. 412. *Milling and Baking Tests with Durum Wheat.*
  - No. 413. *The Care of Milk and its Uses in the Home.*
  - No. 535. *Sugar and its Value as Food.*
- The following bulletins can be had by writing to the University Publisher, University of Missouri, Columbia, Missouri:
- Preservation of Food.*
  - Cooking of Vegetables.*
  - Candy Making.*

#### TEXTILES AND CLOTHING

- No. 27. *Flax from Seed to Fiber.*
- No. 69. *Flax Culture.*
- No. 137. *Angora Goat.*
- No. 165. *Silk Worm Culture.*
- No. 274. *Flax Culture.*
- No. 302. *Sea Island Cotton.*

Other valuable bulletins, issued *free*, are as follows:

- Office of Experiment Station, Washington, D. C.  
 No. 33. *The Cotton Plant; History, Botany, Characteristics, Culture and Uses.*  
 Office of Fiber Investigation, Washington, D. C.  
 Report, No. 4. *Flax Culture in Ireland, Belgium, Austria, Russia.*  
 Report, No. 106. *Flax for Seed and Fiber.*

A number of universities publish from time to time bulletins of special interest to teachers of Home Economics. Frequently these are mailed free to teachers on request, although they are not intended for general free distribution.

Teachers College, Columbia University, New York City, has a number of bulletins on Home Economics. The price list of these can be obtained by writing to the Division of Publications, Teachers College, Columbia University, New York City.

Those who wish to have their names placed on the mailing list for free bulletins on Home Economics published by the University of Missouri, should send requests to Department of Home Economics, University of Missouri, Columbia, Missouri.

## ECONOMICS

For references in General Economics, see page 48. To that list might be added:

- \*\*Bullock, *Select Readings in Economics*, Ginn [330].....S 2.25  
 Fetter, *Principles of Economics*, Century [330]..... 2.00  
 Seligman, *Principles of Economics*, Longmans [330]..... 2.50  
 \*\*Fetter, *Source Book in Economics*, Century Co. [330]..... 1.30

## COMMERCIAL GEOGRAPHY

- Pan-American Union*, Bulletin, Washington, D. C. [380.5]  
*Census Reports* (To be found in most city libraries or college libraries). [317]  
 \*\*Chisholm, *Handbook of Commercial Geography*, Longmans [910].....S 4.80  
 \*\*Day, *A History of Commerce*, Longmans [380.9]..... 2.00  
 \*\*Freeman and Chandler, *World's Commercial Products*, Ginn [380]..... 3.50  
 Gregory, Keller and Bishop, *Physical and Commercial Geography*, Ginn [910]..... 3.00  
 Hannan, *Textile Fibre of Commerce*, Lippincott [677]..... 3.00  
 \*\*Lyde, *Commercial Atlas*, Macmillan [910]..... .90  
 \*\*Magazines, such as *World's Work*, *Review of Reviews*, *National*

* <i>Geographic Magazine, Journal of Geography, or Bulletin of American Geographic Society.</i>	
Mill, <i>International Geography</i> , Appleton [910].....	\$ 3.50
**Ries, <i>Economic Geology</i> , Macmillan [553].....	3.50
** <i>Statesman's Year Book</i> (Annual), Macmillan [310].....	3.00
** <i>Statistical Abstract United States</i> [317], free.	
<i>Transportation by Water</i> , Rept. of Com. of Corporations, Washington, D. C. [387]	
**Van Hise, <i>Conservation of Natural Resources</i> , Macmillan [333]	2.00
Willis, <i>Agriculture in the Tropics</i> , Putnam [630].....	2.50
** <i>Year Book of Department of Agriculture</i> , Secretary of Agriculture, Washington, D. C. [630], free.	

### TEACHER-TRAINING COURSES

For library equipment for teacher-training courses, see syllabus issued by State Superintendent of Public Schools, Jefferson City, Missouri.

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# THE UNIVERSITY OF MISSOURI BULLETIN

VOLUME 16      NUMBER 22

EDUCATION SERIES 11

## A STUDY OF THE RURAL SCHOOLS OF SALINE COUNTY, MISSOURI

by

JOSEPH DOLIVER ELLIFF

*Professor of High School Administration and High School Visitor,  
University of Missouri*

and

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*Fellow in Education, University of Missouri*



UNIVERSITY OF MISSOURI  
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## FOREWORD

The great development of Missouri schools in recent years has been confined, with few exceptions, to the schools of cities and towns. Altho there has been much favorable legislation, altho the State Department of Education has been competent and sympathetic, altho county superintendents have given their best efforts to the improvement of rural education, the rural schools have made comparatively little progress. To find why the rural schools have not made greater progress is one of the most important problems confronting the people of Missouri. The first step in solving this problem is to secure, with accuracy and detail, the facts of the situation. Accordingly, a movement has been started to study the rural schools of a number of counties of the State for the purpose of finding these facts. Because Saline County is representative of the better agricultural counties, its schools have been selected for the first study.

As noted elsewhere, nothing given in this bulletin should be construed as either a criticism or a defense of the schools concerned. The purpose of the bulletin is to give only a statement of the facts, which will increase in significance as similar statements are secured with regard to the rural schools of other counties in Missouri.

It is only thru the cooperation of a large number of persons that any systematic study of a system of schools is possible. The authors wish to acknowledge their indebtedness to the following:

1. The teachers in the rural schools of Saline County, from whom a large part of the information was obtained.
2. Mr. J. L. Lynch, superintendent of the schools of Saline County, for free access to the records of his office and for valuable suggestions.
3. Professors I. N. Evrard, W. Y. Lockridge, and J. J. Dynes of Missouri Valley College; Professors J. H. Coursault

and L. L. Bernard of the University of Missouri; Mr. G. W. Reavis of the State Department of Education; and Messrs. J. B. Boyd, W. H. Hargrove, E. O. Wiley, and A. S. Hurt, students in the University of Missouri, for assistance in visiting schools.

4. Dean W. W. Charters of the School of Education of the University of Missouri for assistance in the preparation of the blank forms used and for valuable suggestions concerning all phases of the work.

JOSEPH D. ELLIFF

ABNER JONES

# A STUDY OF THE RURAL SCHOOLS OF SALINE COUNTY, MISSOURI

## GENERAL DESCRIPTION OF SALINE COUNTY

Saline County, which is selected for this study, is situated in a large bend on the south side of the Missouri River, about two-thirds of the distance from the eastern to the western border of the state. Rich soil and a navigable waterway made it attractive. Accordingly, it is one of the earlier settled counties of the state, the first settlement having been made in 1810. The growth was slow for a time, but by 1820 several hundred people had come, mostly from Kentucky, Tennessee, Virginia, and Indiana, and lived in settlements for protection against the Indians. At a later date a number of Germans located in the county.

Saline County is a typical Missouri agricultural county of the wealthier sort. On account of rich soil, favorable climate, and accessibility to market, the agricultural conditions of the county are better than the average agricultural conditions of the state. Social conditions are not materially different from those of the state as a whole.

There are two general topographical regions in the county, the river bottoms and the uplands. The bottom land comprises about 125,000 acres along the Missouri River, which forms the boundary for a distance of some seventy-five miles. These bottoms are level and low, subject to frequent inundation, and poorly drained. The uplands vary from a fairly level to a broken and hilly surface, most of it being gently rolling. The broken land is found along the river bluffs and on the smaller streams.

The large area of rich soil is the distinguishing feature of the county. More than 73 per cent of the total area of 478,656 acres is of loessial origin, very rich and fertile. About 65 per cent of the area is a gently rolling, well-drained surface

covered with "Marshall silt loam," a soil that produces from 30 to 100 bushels of corn per acre. Yields of more than 120 bushels per acre have been raised on this soil. The soil in the river bottom varies from sandy soil to heavy gumbo. Some large crops are produced; but, owing to its liability to overflow and the difficulty of handling the heavy soil, this land is not so valuable as the upland. The land ranges in value from \$35 to \$200 per acre, with an average value, according to the United States Census of 1910, of \$76.57.

The Chicago and Alton Railroad and two branches of the Missouri Pacific Railroad give easy and direct access to the Kansas City, St. Louis, and Chicago markets. Kansas City is only sixty miles distant. Besides the railways, there are about 4829 miles of dirt roads, many of which, including both the Sante Fe trail and the north and south state highway, are well cared for.

The rich soil of the county is well adapted to the production of corn, which is the chief product. The enormous corn yields are mostly fed to large numbers of cattle and hogs. In 1912 and 1913, Saline County ranked first in the state in the amount of corn produced; and in 1914, it ranked fourth. In the number of bushels per acre produced, it ranked second in 1912, fifth in 1913, and eleventh in 1914. During the three years mentioned, the county produced from  $\frac{1}{4}\frac{1}{2}$  to  $\frac{1}{3}\frac{1}{3}$  of all corn produced in the state, with a total yield of from 3,722,732 to 6,143,364 bushels.

Next to corn, wheat is the most important crop. In 1914 the county produced 1,438,356 bushels of wheat, more than  $\frac{1}{26}$  of the 36,933,501 bushels produced by the whole state. It ranked first among the counties of the state in the amount of wheat produced.

The census of 1910 shows the productivity of the county to be proportionately greater than that of the state at large. The total value of all farm crops in the county is reported to be \$4,527,698, while that of the whole state is \$220,663,724. Saline County, therefore, produces approximately  $\frac{1}{49}$  of the farm crops of the state. In the total value of animals sold and slaughtered and of poultry and dairy products, Saline

County produced approximately  $\frac{1}{34}$  of the total amount produced in the state, the figures being respectively \$3,445,230 and \$185,713,058. These figures may not mean that the county is more productive than the average of the state for the same area, since the county is a large one. However, a comparison of the rural population of the county with that of the state shows that the county has only about  $\frac{1}{88}$  of the rural population of the state. The rural population to the square mile in the county is 28.3, and in the state it is 27.6.

Another way of determining the relative material prosperity of the county is to compare the value of the land and other farm property of the county with that of the state. The census of 1910 shows the average value of farm lands in the county to be \$76.57 per acre, while that of the state is \$41.80 per acre. The value of all farm property per farm in the county is \$14,089, while for the state it is only \$7,405. With this great difference in the average wealth per farm, there is little difference in the average size of the farms, which is 138.1 acres for the county and 124.8 for the state.

A slightly greater amount of tenantry in the county and a slightly less freedom from mortgage debt of farm owners operating their own farms than in the state as a whole, may have little significance. In the county 65.9 per cent of the farms are operated by their owners, while in the state 70 per cent of the farms are operated by their owners. In the county almost exactly 50 per cent of the farms operated by their owners are free from mortgage debt, while in the state the percentage is 53.7. The difference is not great.

The population statistics of the last census show Saline County to have, as compared to the state as a whole, a larger percentage of rural population, of native born population, and of negro population respectively, a smaller percentage of illiteracy among whites, and a larger percentage of illiteracy among the negroes. It had proportionately a smaller increase in urban population and a larger decrease in rural population in the ten-year period from 1900 to 1910 than the state as a whole. Of the population of the county, 72.5 per cent is rural; and of the population of the state, 57.5 per cent is rural. The

native-born whites of native parents in the county are 77.2 per cent of the total, while in the state they are 72.5 per cent of the total. The negro population of the county is 12.8 per cent, while of the state it is 4.8 per cent. The illiteracy of the native whites in the county is 2.6 per cent, and in the state it is 2.9 per cent; while among the negroes, the county shows an illiteracy of 20 per cent and the state 17.4 per cent. The census of 1910 shows a decrease in the rural population of many agricultural sections. In Missouri the decrease was 3.5 per cent, but in Saline County it was 18.5 per cent; while the urban population in both county and state increased for the same period, 6.8 per cent in the county and 22.3 per cent in the state. The urban movement is to some extent both cause and effect of the unsatisfactory condition of the rural schools.

Compared with the average run of counties of the state, Saline County is well supplied with educational facilities. Marshall, the county seat, is the seat of Missouri Valley College, a standard four-year college under the control of the Presbyterian Church. A few church schools of elementary grade are maintained in the county. First-class public high schools are maintained at Marshall, Slater, and Sweet Springs; Miami and Blackburn have third-class high schools; while five other towns have unclassified high schools; making ten city, town, and village schools. There are 112 rural district schools in the county, 106 of which were inspected.

## THE RURAL SCHOOLS OF SALINE COUNTY

No real national system of schools exists in the United States. The national government, having laid a broad foundation and made liberal provision for a system of free schools in all the states, has left each state free to work out its own plan for these schools in its own way. The national contribution was in money and land. Having vested the title in the state and placed such safeguards as seemed wise, the national government left the state practically free to use or squander its inheritance. Since the states were left free to work out



their own school systems, naturally different types of state administrative systems developed.

State school systems may be roughly divided into two groups, the *centralized* and the *decentralized*. Between these two there are all degrees of difference. In both types the state, by constitutional provision and legislative enactment, makes possible a complete system of free schools. In the centralized type the state goes further and assumes the responsibility and exercises a maximum amount of control, leaving only a minimum amount of control to the local community or district. In the decentralized type the reverse is true, the maximum responsibility and control being left to the local district. The Missouri school system is an excellent illustration of the decentralized or democratic type of school administration. Whether there is a good school or none depends primarily not upon the state, but upon the people in the particular school district. A full understanding of this fact is an aid in understanding recent educational development in Missouri and in answering, in some measure at least, the question: How shall the *unequal* educational opportunities in different communities be accounted for?

In recent years there has been a wonderful growth and development in Missouri schools. In some respects, notably in the case of the public high schools, the development has been almost phenomenal. For the most part, however, the growth has been confined to the towns and cities, only here and there a rural community being found that has made any such advancement as has been made in the towns. The difference cannot be explained on the basis of favorable or unfavorable legislation; for, beginning with the law providing for county supervision, each General Assembly has passed laws specifically designed for the betterment of rural schools. In spite of favorable legislation, in spite of the best efforts of a thoroly competent sympathetic State Department of Education, in spite of the best efforts of county superintendents, the rural schools show comparatively little progress. *Why?*

To find the true answer to this question is one of the most important problems confronting the people of Missouri. No

incomplete or partial solution will answer the purpose; the real underlying causes must be found and removed. In order to do this, all the available facts must be found, if possible. The facts must then be studied in their relation to one another and to the complex whole of which they are parts. It was for the purpose of securing some of the facts that this study was undertaken. This study is in no sense a complete survey of the rural schools of Saline County. Nothing in it is to be construed as a criticism or a defense of the schools. The sole purpose of the study is to get an accurate first-hand statement of the facts.

It will be observed that the facts recorded may be divided into two groups:

1. Measurement and observation; e. g., the ratio of light space to floor space, the condition of the privies.
2. Facts involving a judgment; e. g., the attitude of the people toward the school, the value of the best barn in the district.

All measurements and observations were made on the ground at the time the school was visited, and were made by inspectors each of whom is a trained school man of successful experience. Before beginning work, each inspector was given a blank form on which to record the observations and was instructed in its use. Each was given a tape measure, and the necessary chemicals for testing the drinking water. It was found that some of the information which should have been available in the school records could not be obtained. In every case investigated, the district records were in poor form.

Since it is believed that the facts will interpret themselves, they are submitted with only such comment as will make clear their origin and nature. Not all the data gathered, but only the more important, have been used. The reports on each school have been kept and may be made the basis of a further study.

Where not otherwise specified, the figures in the tables which follow indicate the number of rooms.

### Heating and Ventilation

1. Kind of heating plant
  - 77 unjacketed stoves
  - 23 jacketed stoves
  - 10 furnace stoves
2. Location of heating plant
  - 76 near the center of room
  - 33 in the corner of room
  - 1 in basement
3. Kind of fuel used
  - 98 coal
  - 12 wood
4. Place for keeping fuel
  - 6 in house
  - 14 in yard
  - 90 in fuel shed
5. Ventilation
  - 86 by windows and doors only, 3 having boards under windows to prevent drafts
  - 14 by jacketed stoves, the jacketed stoves having no outside air intakes and providing merely for the circulation of the air in the room
  - 10 by furnace

### Lighting

1. Ratio of floor space to window space
  - 3 with ratio of 4 to 1
  - 5 with ratio of 5 to 1
  - 20 with ratio of 6 to 1
  - 21 with ratio of 7 to 1
  - 15 with ratio of 8 to 1
  - 17 with ratio of 9 to 1
  - 14 with ratio of 10 to 1
  - 5 with ratio of 11 to 1
  - 5 with ratio of 12 to 1
  - 4 with ratio of 13 to 1
  - 1 with ratio of 16 to 1

Only eight rooms had sufficient light space in proportion to floor space; that is, at least 1 to 5.

2. Location of windows
  - 105 rooms with cross lights; i. e., windows on opposite sides

3. Window shades
  - 6 rooms with no shades
  - 34 rooms with shades in good condition
  - 30 rooms with shades in fair condition
  - 40 rooms with shades in poor condition

In every case the shades were improperly placed, shading the upper part of the window.

### Seating

- 84 with double desks
- 26 with single desks
- 19 with broken desks, the number of broken desks being 106
- 461 pupils were improperly seated; i. e., feet dangling or seat too small

### Care of Room

1. Floors oiled
  - 7 annually
  - 2 more frequently
  - 101 never
2. Floors scrubbed
  - 61 annually
  - 32 more frequently
  - 17 never
3. Floors swept
  - 103 daily
    - 7 at irregular intervals
    - 0 with use of sweeping mixture
  - 63 by the teacher
  - 23 by the pupils
  - 24 by janitor
  - 41 by teachers without pay for sweeping
  - 22 by teachers paid from one to five dollars per month for sweeping

### Water-Closets

- 12 with urinals
- 18 with screens
- 5 with boxes for excreta
- 28 clean
- 70 marked or cut
- 30 marked or cut obscenely

- 24 scrubbed annually
- 4 scrubbed monthly
- 7 scrubbed at irregular times
- 70 never scrubbed
- 16 cleaned out underneath annually
- 5 cleaned out underneath semiannually
- 84 never cleaned

All closets were earth privies. Three schools had no closets for boys, and one school had no usable privy for boys or girls.

### Cloakrooms

- 15 with separate cloakrooms for boys and girls
- 23 with common cloakrooms for boys and girls
- 72 with no cloakroom

### Drinking Water

- 24 with dug wells
- 50 with cisterns
- 29 with driven wells
- 3 with springs
- 76 with wells and cisterns covered
- 51 with wells and cisterns liable to contamination from surface drainage
- 22 with cisterns never cleaned

In 68 of the 106 cases, the examiners' tests of the water supply were unfavorable. This was a simple chemical test to determine the presence or absence of soluble chlorides. An unfavorable test simply meant that the water supply was questionable and that it should be examined by a chemist or practicing physician before being used. Forty-five schools had individual drinking cups for some pupils.

### Physical Examination

No school had physical examination of the children.

### Play and Playgrounds

1. Apparatus
  - 12 schools with some playground apparatus
  - 98 schools with no playground apparatus
  - 55 schools reported that children play much
2. Games played. (Observed by inspector or reported by teacher and pupils)

- 58 black man
- 3 fox and dog
- 11 tag
- 22 town ball
- 7 "antie over"
- 6 basket ball
- 33 baseball
- 16 drop the handkerchief
- 3. Supervision
  - 26 with play organized by the teacher
  - 42 with play supervised by the teacher
- 4. Size of unobstructed playground
  - 30 with  $\frac{1}{4}$  acre
  - 20 with  $\frac{1}{2}$  acre
  - 14 with  $\frac{3}{4}$  acre
  - 14 with 1 acre
  - 2 with  $1\frac{1}{4}$  acres
  - 4 with  $1\frac{1}{2}$  acres
  - 3 with 2 acres
  - 4 with no playground

#### Provision for Hot Lunch

No school had provision for hot lunch.

#### Building and Grounds

- 1. Material of building
  - 5 brick buildings
  - 101 frame buildings
- 2. Years since building was painted (Reported by teacher, pupils, and patrons)
  - 6 one year
  - 4 two years
  - 1 three years
  - 1 four years
  - 42 five years
  - 8 six years
  - 28 more than six years
  - 7 never painted
- 3. Condition of buildings
  - 38 in good repair
  - 31 in fair repair
  - 37 in poor repair
  - 16 artistic
  - 31 buildings with broken windows, a total of 69 panes missing

4. Fences
  - 69 with grounds fenced
  - 22 with fence in good repair
  - 20 with fence in fair repair
  - 27 with fence in poor repair
5. Lawns
  - 67 with well grassed lawns
  - 62 with lawns mowed annually
  - 12 with lawns mowed occasionally
  - 31 with lawns never mowed
6. Landscape gardening
  - 67 with grounds apparently neglected
  - 3 with some attempt at landscape gardening
  - 73 with beautiful natural surroundings
7. Interior decoration
  - 39 with pleasing interior effect
  - 66 with good pictures on the walls
  - 31 with decorations other than pictures
  - 21 with artistic tinting

### Equipment

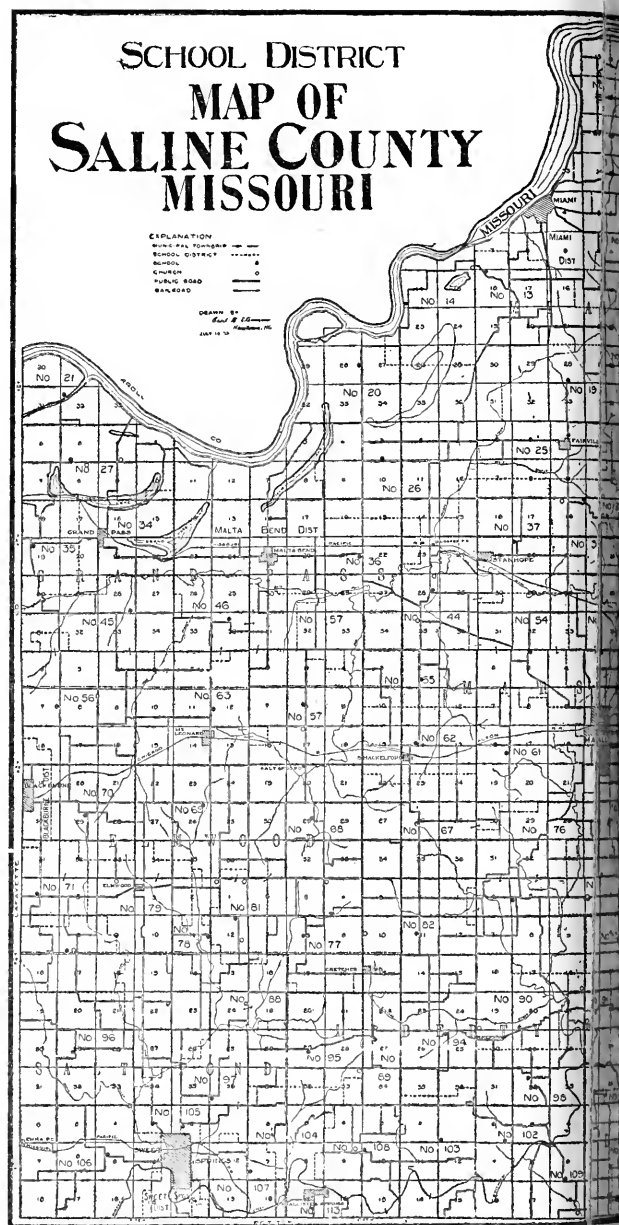
1. Libraries

Volumes in libraries: total 11,443; lowest number 0; highest number 420; average number 102.

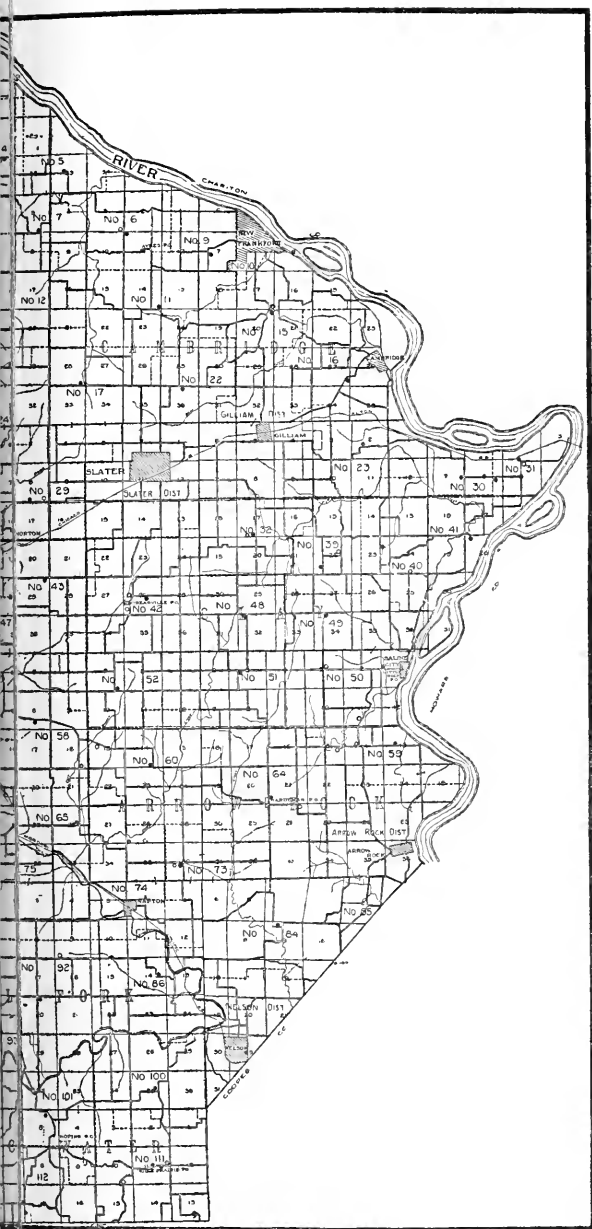
Value of libraries: total \$3852; lowest \$0; highest \$140; average \$35.

Percentage of useless books: lowest 0; highest 85; median 7.

  - 26 with books in good condition
  - 44 with books in fair condition
  - 40 with books in poor condition
  - 12 with boards obeying the library law
  - 19 with books paid for by the boards
  - 75 with books paid for through entertainments
  - 26 with good selection of books
  - 51 with fairly good selection of books
  - 33 with poor selection of books
2. Blackboards
  - 41 with slate blackboards
  - 18 with composition blackboards
  - 29 with wood blackboards
  - 22 with plaster blackboards
  - 54 with enough blackboard space (3 sq. ft. per pupil)
  - 96 with ordinary chalk
  - 14 with dustless chalk







3. Teacher's desk
    - 54 with teachers' desks in good condition
    - 25 with teachers' desks in fair condition
    - 30 with teachers' desks in poor condition
    - 1 with no teacher's desk.
  4. Supply of books on teachers' desks
    - 13 with good supply
    - 23 with fair supply
    - 58 with poor supply
    - 16 with no supply
- All desk books were paid for by the teachers.
5. Miscellaneous
    - 57 with good dust-proof book cases
    - 13 with cabinets
    - 15 with organs
    - 0 with a piano or phonograph
    - 1 with a museum
    - 1 with free textbooks
    - 86 with one or more maps
    - 41 with enough maps (Missouri, United States, continents)
    - 72 with enough good erasers
      - 1 with some equipment for teaching manual training
      - 11 with some equipment for teaching agriculture
      - 30 with measuring sticks for teaching arithmetic
        - 1 with balance and weights for teaching arithmetic
        - 2 with liquid or dry measure for teaching arithmetic
        - 2 with some equipment for sewing
        - 1 with some equipment for cooking
      - 50 schools used slates
      - 281 pupils used slates
  6. Textbooks
    - 80 with all pupils fully supplied

### Finance

The financial statistics were obtained from the records in the office of the county superintendent of schools and are for the school year 1913-14. In most cases the district clerks failed to make a full detailed statement of receipts and expenditures by funds as the law requires.

#### 1. Taxation

Assessed valuation: total (76 districts) \$7,137,065; lowest \$12,930; highest \$215,000; median\* \$70,000; middle 50 per cent \$49,500 to \$109,285.

Levy for school purposes (cents on \$100): highest 75; lowest 0; median 40; middle 50 per cent 40 to 65; 37 levied 40c and 27 levied 65c.

\* The median is the case which was found in the investigation to have as many cases below it as there are above it.

Levy for interest and sinking fund reported by only two districts, one 15c and the other 25c on \$100.

Levy for building: seven cases reported lowest 10c and highest 25c on \$100.

Total tax levy (cents on \$100): highest 90; lowest 0; median 40; middle 50 per cent 40 to 65; 38 districts levied 40c; 21 districts levied 65c.

Receipts last year (93 districts)

Cash on hand: total \$15,092; lowest \$2; highest \$1260; median \$115; middle 50 per cent \$44 to \$221.

2. Receipts from permanent funds

State: total \$8,589; highest \$378; lowest \$30; median \$73; middle 50 per cent \$68 to \$90.

County: total \$3,273; highest \$102; lowest \$7; median \$33; middle 50 per cent \$24 to \$41.

Township: total \$1328; highest \$165; lowest \$1; median \$8; middle 50 per cent \$5 to \$17.

Railroad: total \$5908; highest \$146; lowest \$28; median \$68; middle 50 per cent \$50 to \$95.

Total from public funds (78 cases) highest \$538; lowest \$66; median \$194; middle 50 per cent \$140 to \$227.

3. Receipts from local funds (87 cases)

For school purposes: total \$28,823; highest \$885; lowest \$101; median \$310; middle 50 per cent \$218 to \$430.

For interest, building, and miscellaneous there are no data.

4. Expenditures last year (97 cases)

Teachers: total \$42,023; highest \$880 (two teachers); lowest \$180; median \$397; middle 50 per cent \$305 to \$490.

Clerk: total \$1024; highest \$25; lowest \$0; median \$10; middle 50 per cent \$10 to \$12.

Fuel: total \$5769; highest \$68; lowest \$4; median \$25; middle 50 per cent \$18 to \$34.

Total expenditures: highest \$1097; lowest \$189; median \$481; middle 50 per cent \$380 to \$641.

5. Salary of teacher per month (104 cases)

Total \$5292; highest \$80; lowest \$32.50; median \$50; middle 50 per cent \$45 to \$60.

6. Values of school buildings compared with values of barns

Value of best barn in district (80 cases): highest \$3500; lowest \$200; median \$1200; middle 50 per cent \$1000 to \$1500.

Value of average barn (80 cases): highest \$1000; lowest \$100; median \$500; middle 50 per cent \$300 to \$500.

Value of school building (91 cases): total \$53,150; highest \$2000; lowest \$150; median \$400; middle 50 per cent \$300 to \$700.

### Attendance

1. Enumeration (94 cases): total 3,732; highest 107; lowest 8; median 37; middle 50 per cent 28 to 47.
2. Enrollment (104 cases): total 2710; highest 66 (a two-room school); lowest 5; median 26; middle 50 per cent 16 to 33. The largest number enrolled in any one-teacher school was 55. The survey was made during the first month, so average attendance was not found.

### Attitude Toward School

1. Wealthy class without children (96 cases)
  - 46 with this class friendly
  - 21 with this class unfriendly
  - 8 with this class indifferent
  - 21 with no data

2. Tenants (83 cases)
  - 70 with tenants interested
  - 13 with no data
  - 0 with tenants uninterested

Per cent of tenants: highest 100 per cent; lowest 2 per cent; median 25 per cent.

3. Community as a whole (98 cases)
  - No community with very strong interest in school
  - 20 communities with strong interest in school
  - 40 communities with fairly strong interest in school
  - 36 communities indifferent to school
  - 2 communities opposed to school

### Use of School Buildings During Previous Year

1. Farmers' meetings
  - 95 not used
  - 8 used

Two buildings were used for this purpose three times each; one was used two times, and the others were used once each.

2. Social meetings (chiefly school entertainments for the purpose of raising money)

56 not used

45 used

Four times was the most any building was used for this purpose.

3. Debating societies

99 not used

1 used

4. Political meetings

4 used, two times having been the maximum in any case

96 not used

5. School meetings

98 used

1 not used

One building was used five times, and most of the buildings were used only once.

6. Religious meetings

5 used, one having been used weekly, one monthly

7. All other purposes

5 used

8. Attitude of communities toward a wider use of the school plant

12 opposed

20 favorable

34 indifferent

44 no data

### Instruction

1. Teachers living conditions

Salary per month (see page 19)

Board per week: highest \$5; lowest \$1.50; median \$3. 38 teachers live at home, 26 of these pay no board.

Distance teacher lives from school: farthest 9 miles; closest less than  $\frac{1}{4}$  mile; median  $\frac{3}{4}$  mile; middle 50 per cent  $\frac{1}{4}$  to 2 miles

2. Age of teacher (106 cases)

41 from 18 to 21 inclusive

32 from 22 to 25

9 from 26 to 29

24 more than 29

Lowest 18; highest 66.

3. Sex of teachers

24 male

86 female

4. Grade of certificate
  - 1 special
  - 33 third grade
  - 50 second grade
  - 18 first grade
  - 1 normal diploma
  - 4 teacher training
  - 3 no data
5. Number of months experience of teachers at beginning of term (108 cases)
  - 39 with 8 or less
  - 14 with 9 to 16 inclusive
  - 9 with 17 to 24 inclusive
  - 9 with 25 to 32 inclusive
  - 25 with no previous experienceHighest 280; lowest 0; middle 50 per cent 8 to 48.
6. Number of years in high school (105 cases): lowest 0; highest 5 (2 cases); median 4 (78 cases)
7. Number of years in college or university: lowest 0 (69 cases); highest 4 (2 cases); less than one year 19 cases; one year 8 cases; more than one and less than four years 7 cases.
8. Number of terms in normal school
  - 59 had not attended
  - 29 had attended one term
  - 14 had attended two or three terms
  - 3 had attended more than three terms
9. Number of months in present school (108 cases)
  - 77 less than 9 months
  - 17 from 9 to 16 months
  - 5 from 17 to 24 months
  - 9 more than 24 months
10. Lines of study carried on by teachers
  - 25 reading circle work
  - 5 "general" work
  - 1 correspondence work
  - 1 musical work
11. Records
  - 110 with record of absences in all cases
  - 40 with record of causes of absences
  - 87 with record of class standing in permanent form
  - 41 with last term's report in the building
12. Permanence of teaching force
  - Number of teachers since 1908 (104 cases)
  - 2 with one teacher

- 10 with two teachers
- 24 with three teachers
- 28 with four teachers
- 26 with five teachers
- 11 with six teachers
- 3 with seven teachers
- 13. General discipline (inspector's judgment)
  - 21 teachers nagged
  - 79 schools had children happy in their work (inspectors reporting pupils happy if they did not seem to be unhappy)
  - 68 schools had lively school spirit (see comment above)
  - 42 schools had lifeless school spirit
  - 60 teachers were likable
  - 6 teachers were unlikable
  - 44 teachers were neither likable nor unlikable
  - 53 teachers had a good sense of humor
- No data for corporal punishment.
- 14. General character of daily program
  - 78 with well defined daily programs
  - 32 with no well defined daily program
  - 59 with alternations
- 15. Number of class periods per day per teacher
  - 12 with less than 24 class periods daily
  - 18 with 24 class periods daily
  - 10 with more than 24 and less than 30 periods daily
  - 15 with 30 class periods daily
  - 13 with more than 30 class periods daily
  - Lowest number 16; highest 34.
- 16. Character of teaching (inspector's judgment)
  - 75 with teachers following the book in class work
  - 35 with teachers following the pupil in class work
  - 90 with teachers having a good standard of personal speech
  - 51 with good English required of pupils
  - 69 with motivation through generic appeals
  - 15 with motivation through intrinsic function of subject-matter
  - 54 with text-books used intelligently
  - 56 with text-books used unintelligently
  - 88 with test questions chiefly
  - 13 with developing questions
  - 57 with pupils having opportunity to think
  - 19 with subject-matter usually told to the pupils
  - 80 with pupils usually getting subject-matter from the book
  - 23 with summaries made wisely
  - 35 with adequate drill
  - 18 with applications of knowledge made

- 34 with teachers giving concrete instruction
- 69 with teachers giving abstract instruction
- 17. Results of teachers' work (inspector's judgment)
  - 21 with pupils understanding intrinsic function of subject-matter
  - 23 with pupils able to organize subject-matter
  - 45 with pupils skillful in memory and drill operations
  - 23 with pupils making applications intelligently
  - 60 with pupils liking their work
  - 2 with organizations effective in school life

### The Rural School Board

In most cases the official records of the district could not be secured. In no case were the district records well kept. From conversations with teachers, district clerks, and members of the boards, it was learned that the usual method of doing business was as follows: The newly elected board held a short meeting for the purpose of organization at the time of the annual election. Quite commonly this was the only full meeting of the board during the year. The teacher was employed, supplies purchased, contracts entered into, and warrants drawn, all without a meeting of the board and contrary to law.

In the employment of a teacher, the members of the board separately interviewed the applicants, the prospective teacher making the rounds of the board. The first member interviewed by the applicant would tell her whether he favored her election; the next member would then be visited and would be told what the first one said. If the second member was favorable, the matter was considered settled, and the clerk would draw up a contract and sign it. The fortunate applicant would take the contract to the president of the board, who would attach his signature to it. Warrants were issued in much the same way, the teacher's monthly report being filed with the district clerk, who would fill out and sign a warrant for the month's salary. The teacher would then take the warrant to the president of the board for his signature.

### Illustrations of Unequal Educational Advantages

(Data for one-room schools)

Assessed valuation of districts: highest \$215,000; lowest \$12,930.  
 Enumeration of districts: highest 107; lowest 8.  
 Total tax levy of districts: highest \$0.90; lowest 0.  
 Value of school buildings: highest \$1500; lowest \$150.  
 Annual salary of teacher: highest \$640; lowest \$180.

### Comparative Value of Barn and Schoolhouse

Median value of schoolhouse.....	\$ 400
Median value of average barn .....	500
Median value of best barn.....	1200



## SUMMARY—THE MEDIAN SCHOOL

Perhaps the *median*\* is the most significant single measure of any group of related facts. There is, of course, no such thing as a median school. If, however, a hypothetical school is constructed on the basis of the medians for the entire group, the result will be a fairly accurate statement that will serve as an excellent typical case and will fairly represent the county as a whole.

The median district has an enumeration of 37 and an average daily attendance of 20. The assessed valuation is \$70,000 and the school tax forty cents on the hundred dollars. The receipts and expenditures for the year are as follows: received from direct taxation \$280; from state \$73; from county \$33; from township \$8; from railroad \$68; total \$462. The teacher's salary is \$400. The amount spent for all other purposes is \$50.

The building, which is worth \$400 (about \$100 less than the average barn in the district), is well located but in rather poor repair. It is the usual box-car type of construction, warmed by a coal stove placed near the center of the room. There is no means of ventilation, except the windows and doors. The lighting is very deficient, there being cross-lights and a ratio of light space to window space of one to eight. There are ordinary green shades, but they are improperly placed so as to shade the upper part of the windows. The floors are of hard pine, never oiled, scrubbed once last year, and swept daily by the teacher, who is not paid for the work.

The water-closets are earth privies without urinals, screens, or boxes for excreta. They are near the house and in plain view of each other. They are never scrubbed, never cleaned out underneath, and are badly marked and cut.

The drinking water is obtained from a cistern in the school yard and is liable to contamination from surface drain-

\* The median is the case which was found in the investigation to have as many cases below it as there are above it.

age. The cistern has not been cleaned for a long time, the pupils have drinking cups in common, and the water is probably unfit for drinking purposes.

The school grounds are rectangular in form, about three fourths of an acre in area, and fenced with a wire and board fence. The plot is well grassed and was mowed last summer. The children are not taught to play and the play is not supervised. There is no playground apparatus and the children play "drop the handkerchief," "town ball," and baseball.

The equipment consists of a library of 102 books, worth about \$35. Of the library books 7 per cent are useless. The books are in a fair state of repair and are kept in a good bookcase. They were selected by the teacher and paid for with the receipts from box suppers.

There is enough good blackboard, but it is too high to be of the best service to the smaller children. The teacher's desk is in fair condition and is fairly well supplied with books, which she herself has paid for. There is no equipment for teaching arithmetic, manual training, agriculture, cooking, or sewing.

The pupils are well supplied with textbooks.

Of the people in the district, 25 per cent are tenants. There is a fairly strong interest in the school on the part of the patrons. The building was used twice last year for public meetings, once for a school meeting and once for a box supper.

The teacher is twenty-two years of age and this is her second year in teaching but her first year in this school. She is a graduate of a first-class four-year high school and holds a second grade county certificate. She has never attended college or normal school, has had no professional training, and in fact, is doing no professional work this year.

## COMPARISON WITH OTHER SCHOOLS

The report of the state superintendent for 1913-14 gives some facts that are used as a basis for a comparison of the rural schools of Saline County with those of the state and with those of the towns of the county, especially Marshall. Marshall is

the largest city in the county and has the most efficient schools. Statistics are not given separately in the report for the rural schools of the county, but they are given for the city and village schools. The figures for the rural schools were obtained by subtracting the combined figures for the ten towns from the figures for the county. The instruction in the rural school is practically all of elementary grade. The figures for elementary instruction in the towns were determined by subtracting the figures for the high schools from the total in all cases where the figures were not given separately for the elementary grades.

The following table shows the rural districts of Saline County to have a larger enumeration and also a larger total enrollment than the ten towns of the county, but that the total number of days attended in the towns is greater than the total number of days attended in the country, and that in the ten towns of the county more than three times as many pupils finished the eighth grade as in the rural districts.

	<i>Ten Towns</i>	<i>Rural Districts</i>
Enumeration.....	3506	3446
Enrollment.....	3089	3232
Total days attended by all pupils.....	441,067	352,890
Graduates of the 8th grade.....	173	52

The following table shows that the ten towns in the county have a total assessed valuation less than half of the total assessed valuation of the rural districts, and that they spend more than twenty per cent more on their schools than the rural districts spend for this purpose.

	<i>Ten Towns</i>	<i>Rural Districts</i>
Valuation.....	\$5,248,350	\$10,849,484
Total expenditure.....	79,738	55,642

The following table shows that most of the better-trained teachers as indicated by the certificate held, are in the towns

of the county. There are three classes of certificates reported, normal school, state, and county, the county being the lowest. This table also shows the greater permanency of service in the towns.

	<i>Ten Towns</i>	<i>Rural Districts</i>
No. of teachers.....	100	122
State teacher's certificates.....	26	3
Normal school certificates.....	35	2
Teacher only one year in present position.....	32	74

The following table shows that the rural schools of Saline County have a larger average assessed valuation per teacher employed and per pupil enumerated than that of the rural districts of the state as a whole, and also larger than that of the city of Marshall. It also shows that the rural schools of Saline County spend more per pupil than the average for the rural schools of the state but less than the city of Marshall.

	<i>Rural— Saline County</i>	<i>Rural— State</i>	<i>Marshall</i>
Assessed valuation per teacher employed.....	\$88,930	\$66,401	\$71,046
Assessed valuation per pupil enumerated.....	3148	1569	2099
Amount expended per pupil enumerated.....	16.15	10.24	27.87
Amount expended per pupil in average attendance....	20.09	18.11	36.16
Amount expended daily per pupil attending.....	.151	.130	.201

The following table shows that the rural schools of Saline County spend more for elementary education per pupil enumerated than the average amount thus expended by the rural

schools of the state or by the city of Marshall. It also shows that, in number of days of school for each pupil and in the proportion finishing the eighth grade, this expenditure produces results greater than the average results produced in the rural districts of the state, but less than the average results produced in the city of Marshall.

	<i>Rural— Saline County</i>	<i>Rural— State</i>	<i>Marshall</i>
Expenditure for elementary education per pupil enumerated.....	16.15	10.24	14.39
Average No. days attended per pupil.....	109.2	95.1	146.9
Percent of enumeration completing the 8th grade....	1.51	1.23	5.59

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EDUCATION SERIES 12

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## INTRODUCTORY

### Reasons for Accrediting

Through a closer organization of educational institutions, the efficiency of education in Missouri has increased rapidly in recent years. When the affairs of each institution were directed independently, the country elementary school did not prepare for the town high school, and the high school did not prepare for college or university. In going from one institution to another, whether of the same or of higher rank, students were seriously interrupted in their work, during a process of readjustment to different educational conditions. But this was not all. The very multiplicity of plans for education under similar social conditions was evidence of the inferiority of many of these plans. They could not all be best. The reason for this is apparent, since differences in plans were based upon differences in mere individual opinions. Organization has, in a large measure, corrected these evils. It has saved students the discouraging loss of time and energy due to interruption in educational work; it has based educational practice not upon individual opinion, but upon the conclusions of many educational experts, conclusions which, in the great laboratory of social practice, have been wisely made, thoroughly tested, and firmly established.

Until the last few years, no provision was made, however, to include in this organization private colleges that give only part of the four years' standard course of academic work. These institutions as a class did not articulate definitely with the common schools on the one hand nor with institutions offering higher collegiate and professional work on the other. It was evident that they too should become a part of the educational system, if their service to society was to be made most efficient.

The recent movement to require a two years' college course as a preparation for the work of professional schools, which in turn has made a division in the four years' course of the college of arts and science, naturally marked a definite function for colleges which did not offer four years of college work. They could give the academic preparation necessary for entrance to the professional schools or to the last two years of the college of arts and science.

Under wise leadership, a number of these private colleges were so developed as to appropriate, in a large measure, those educational standards which have been the result of a wide social experience. With slight modification, they were ready to take their place in the educational system, to fulfill the function which so naturally fell to them.

In view of this, the authorities of a number of these colleges expressed a desire, several years ago, that the place of such institutions in the system be recognized through affiliation with the University of Missouri, which represents the standards of the Association of American Universities. The University, after careful consideration, willingly cooperated with the colleges in this matter. Affiliation with the University has opened an easy pathway to further educational work on the part of the graduates of accredited colleges; it has also marked clearly for patrons of education a number of institutions which comply with the best standards. By definite service in a wider educational order which marks clearly their field of work and sets before them definite ideals, junior colleges are made free to work out their own highest salvation.

### **Basis for Plan of Accrediting**

In formulating a plan for affiliation, the University has taken the initiative. The necessity of this is evident. As a member of the Association of American Universities, the University represents educational standards which are not of its own invention, but are the product of nation-wide experience. Furthermore, it has become closely articulated with many secondary schools of the state upon the basis of definite standards. If any particular college does not conform to accepted standards, it is logical therefore that the college should make a change rather than that the University should attempt to do so. It would be impossible for universities to have a definite educational policy, if they attempted to adapt their work to variations in a number of other institutions doing college work. Only upon the basis of uniform standards can affiliation be made, and these standards are now established.

In affiliating junior colleges, the University does not impose arbitrary conditions for affiliation; the conditions imposed are considered the logical consequences of the educational situation of which the University is only one of many factors. If the authorities of any college believe, however, that the plan presented for affiliation fails in any particular to express the logic of the situation, their criticisms will be welcomed and carefully considered.

### **Purpose of this Circular**

The Missouri Junior College Union, an organization of junior colleges accredited by the University of Missouri, has requested the University Committee on Accredited Schools and Colleges to prepare a statement of courses with a view to standardizing the junior college curriculum. This circular is issued in response to that request. It contains a statement of the conditions for accrediting, outlines of approved courses,



and suggestions for the equipment of laboratories and libraries. Any one college is not expected to offer all of the courses outlined. It is very desirable, however, that the curriculum of each college be made up of courses selected from those described in this bulletin.

### Admission to the University from Accredited Junior Colleges

Although there is a distinction between conditions for the accrediting of junior colleges and conditions for admission to the University from such institutions, some brief information with regard to the conditions for admission may appropriately be given in this introductory statement. Graduates of accredited junior colleges will be admitted without examination to junior standing in the College of Arts and Science of the University, provided they furnish certificates showing that they have satisfied the entrance requirements and the work of the first two years of this college. Such certificates will be accepted also for admission to any other division of the University except the Graduate School, if the student has completed the specific subjects required for admission to such division. For these requirements, see the University catalog. In accrediting a junior college, the approved courses are specified. Credit is not given by the University for junior college courses which are not approved.

*The diploma will not be accepted as a credential.* The student must present the proper form of certificate, signed by the president or dean of the college. Blank certificates will be furnished by the Registrar of the University. The certificates should be filled and sent to the Registrar of the University of Missouri, Columbia, Missouri. He will then notify the student in due time that his certificate has been approved for entrance, or that certain conditions or corrections are necessary. As the necessity for correction appears in many cases, the student will avoid delay and inconvenience by sending the certificate *as soon as possible* after his graduation. *If a student's certificate is presented later than one week before the opening of the semester, he may be required to take entrance examinations.* Certificates filed by candidates become the property of the University.

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Copies of this *Circular of Information to Accredited Junior Colleges* may be secured through the office of the Secretary of the Committee on Accredited Schools and Colleges, University of Missouri, Columbia, Missouri.

## CONDITIONS FOR THE ACCREDITING OF JUNIOR COLLEGES

### Method of Accrediting

An institution desiring to be affiliated with the University of Missouri as an accredited junior college should present, as early in the school year as possible, an application to be accredited, blank forms for which will be furnished upon request by the Secretary of the Committee on Accredited Schools and Colleges. Since the conditions for accrediting cannot be stated with sufficient definiteness to be interpreted alike by various individuals, a committee of the University faculty will visit the institution, if the data received on the blank seem to indicate that the college complies with the conditions for accrediting. Each junior college can thus be tested by the same standards that are applied to other similar institutions. No junior college will be accredited until the report of the Visiting Committee has been passed upon by the University Committee on Accredited Schools and Colleges. It is the policy of the University to keep in close touch with accredited junior colleges through annual visits by the Visiting Committee. *The University reserves the right to cease to accredit at any time a college that employs inefficient teachers or that otherwise fails to maintain the required standard.*

### General Regulations for Accrediting

The *minimum* requirements which a junior college must meet in order to be accredited are as follows:

1. The requirements for admission to the work of the college must be the equivalent of those of the College of Arts and Science in the University of Missouri.

High school subjects which are required for admission are designated in terms of "units." A unit is the equivalent of a subject pursued five forty-minute periods a week for at least thirty-six weeks, except that in the cases of physical and biological sciences, and certain

other subjects, two or more of the five periods each week must be double periods. For these exceptions and further information, see the description of units in annual catalog.

Fifteen units, the equivalent of a four years' high school course, are required for entrance to the College of Arts and Science. Three units in English, one unit in mathematics and two units in one foreign language are fixed requirements, with exception that graduates of secondary schools fully accredited by the University of Missouri are admitted without reference to these fixed requirements. The remaining nine units may be selected from the following list, in which is indicated the maximum and minimum number of units accepted in each subject.

Subjects	Maximum	Minimum
English .....	4	3
Algebra (elementary) .....	1½	1
Plane Geometry .....	1	1
Solid Geometry .....	½	½
Plane Trigonometry .....	½	½
*Arithmetic (advanced) .....	½	½
*Algebra (advanced) .....	½	½
History .....	4	1
American Government .....	½	½
Latin .....	4	2
Greek .....	3	2
German .....	3	2
French .....	3	2
Spanish .....	3	2
Physics .....	2	1
Chemistry .....	2	1
General Biology .....	1	1
Botany .....	2	1
Zoology .....	2	1
Physiology .....	1	1
Physical Geography .....	1	½
Agriculture .....	2	1
Music .....	1	½
Drawing .....	2	1

(Continued )

\*Must be preceded by Elementary Algebra and Plane Geometry. Advanced Arithmetic and Advanced Algebra cannot be offered together.

Subjects (Continued)	Maxi- mum	Mini- mum
†Manual Training .....	2	1
†Domestic Science and Art .....	2	1
†Economics .....	$\frac{1}{2}$	$\frac{1}{2}$
†Commercial Geography .....	$\frac{1}{2}$	$\frac{1}{2}$
†Bookkeeping .....	1	$\frac{1}{2}$
†Stenography and Typewriting .....	1	1
†Teacher-Training Courses .....	2	2

For further information, including list of accredited secondary schools, etc., see annual catalog.



2. If a preparatory school is maintained in connection with the college, its work must be approved by the University of Missouri.

3. The course of study in the college must be two years in length; and the college year, thirty-six weeks.

4. For graduation from the college, the student must complete satisfactorily sixty hours of work, which must be the equivalent of that required in the first two years in the College of Arts and Science in the University of Missouri. The specific requirements are as follows:

(a) six hours of English; (b) five hours of History; (c) ten hours of one foreign language; (d) three hours of Mathematics or Logic; (e) five hours of physical science (Chemistry, Physics, Astronomy, Geology and Geography); (f) five hours of biological science (Botany, Zoology).

These requirements may be waived on the following conditions: If the student presents three units for entrance in the requirement (b) or (d), or two units in the requirement (e) or (f), he will be excused from that requirement. If the student presents three units for entrance in one foreign language, he will be excused from five hours of the requirement (c), and if the student is prepared to enter the second course in a foreign language, he may fulfill the requirement by taking, in addition to this second course, five hours of another foreign language. *Such exemptions do not excuse the student from the requirement of a total of sixty hours for graduation.*

†The maximum amount of commercial and industrial subjects accepted is four units.

†No credit is given unless all three teacher-training courses outlined by the State Superintendent of Public Schools are completed.

By an hour is meant a 60-minute period of class work, or a 120-minute period of laboratory work (exclusive of preparatory instruction and study, work upon notebooks that can be done outside of laboratory, etc.), each week for one semester.

5. Students shall not be permitted to carry for credit work amounting to more than sixteen hours a week.

6. There must be a sufficient number of teachers to conduct the work without crowding the classes, or without assigning to individual teachers an excessive amount or variety of work.

7. All college teachers should have had training equivalent to four years' work in a standard college, and it is desirable that they should have completed one year's graduate work.

8. There must be a laboratory for physical science and a laboratory for biological science, each adequately equipped and sufficiently large to permit easily of individual work upon the part of the students.

9. There must be an adequate library equipment.

10. The college must give satisfactory instruction in the work specified in the fourth requirement, and, in addition, must give satisfactory instruction in other courses which the student may take in completing the conditions for graduation.

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## OUTLINES OF APPROVED SUBJECTS

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For the sake of convenient uniformity, it is suggested that junior colleges affiliated with the University adopt the numbering and nomenclature of courses as given in this Circular. If a course is offered only in the first semester, the letter *a* may be attached to the initial number, as 1a, 2a. If the course is offered only in the second semester, the letter *b* may be attached, as 1b, 2b. If the course is offered in the first semester and repeated in the second, it may be designated as 1a or 1b, 2a or 2b, etc. The number alone may be used to indicate courses continuous through both semesters, as 1, 2. *The number in parenthesis at the end of the description of each course indicates the number of hours' credit which satisfactory completion of the course should count towards graduation.*

It is not expected that all courses described in this Circular will be offered by any one junior college. It is desirable, however, that those courses which are offered conform to the ones described.

### ENGLISH

1. **Composition and Rhetoric.** This course consists of detailed study and practice in construction and in the kinds of composition. The work includes recitations, exercises, themes, conferences, and classroom study of literature illustrative of the different kinds of composition. Such books as the following are suggested as a basis for the course: Ashmun's *The Study and Practice of Writing English*, Woolley's *Handbook of Composition*, Pearson's *Principles of Composition*, Fulton's *College Life*, Palmer's *Self-Cultivation in English*, Palgrave's *Golden Treasury with Additional Poems*, Canby and Pierce's *Selections from Robert Louis Stevenson*.

The main purpose of the course is to train students to write as correctly and effectively as possible. To this end continued drill in spelling, punctuation, grammar, and sentence structure is necessary; and much practice in the development of the paragraph and the whole composition should be given. A carefully prepared theme of about 500 or 600 words each fortnight, an impromptu class theme of one paragraph each fortnight, and, at the end of each semester, a longer theme of about 1200 or 1500 words, involving the use of several sources of information, are suggested as a reasonable amount of writing to be re-

quired. No careless or evidently perfunctory work should receive any credit whatever; and no credit should be given for a theme if a student falls before coming to the conference to make carefully the corrections indicated. The written work, which should be mainly expository in character, should be correlated with the reading in this course and with the knowledge gained by the student in his other courses.

This course should be required of all students except those who enter the college with advanced standing for work done in another standardized college.

Three hours a week for two semesters. (6)

2. **English Literature.** The first half of this course should consist of a careful and thorough class study of selected masterpieces, accompanied with a considerable body of material for outside reading, all arranged according to types. The aim of the course should be as follows: (1) To establish, especially through the class study, habits of careful and intelligent reading; (2) to cultivate and extend a sound appreciation of good literature; (3) to stimulate, especially through the outside work, an active interest in independent reading; (4) to impart a knowledge of the principal types of literature. A typical semester's work might well consist of one of Shakespeare's plays, as representative of the drama, taking about two-thirds of the total class time, and some of Burns' poems, as representative of the lyric. Verity's edition of *King Lear* (Pitt Press series, Putnams, N. Y., agents) would be suitable for the former; and *Selections from Burns*, edited by Dow, (Athenæum Press, Ginn) for the latter. In general, the outside reading should be much more simple than the material read in class. It should be so arranged as to begin, as near as may be, with the student's present interests, and to proceed, by a subtle but progressive adaptation, to selections of richer content and greater literary worth. The great object of the outside reading, or even of the course as a whole, is not so much to impart a formal knowledge of the representative types of literature, as it is to lead the student to read with independent delight the best things in literature.

The second half of this course should consist of a rapid survey of the main periods of English literature. Illustrative readings from the principal authors should be used and the literature which was read in the first semester correlated chronologically. Emphasis should be given to the development of English literature.

Three hours a week for two semesters. (6)

3. **Composition and Literature.** In place of course 1 and 2, a combination course in composition and literature may be given. If this is done, it is important that at least half of the time and energy devoted to the course be given to composition work. Five hours a week for two semesters. (10)

4. **Exposition.** This course consists of practice in writing the various types of essay, with critical study of current exposition. Exercises in logical analysis and organization should be required. The students should receive constructive criticism in regular personal conferences with the teacher. Such books as Smith's *The Mechanism of English Style* and Fulton's *Expository Writing* are suitable as a basis for the course. In the study of current exposition, it is advisable to have the class use such a magazine as the *Atlantic Monthly*, each student subscribing for the magazine for three months. This course is more advanced than English 1. In it the styles of various authors—for example, De Quincey, Carlyle, Macaulay, Stevenson, H. G. Wells, and G. K. Chesterton—should be studied; and, in the light of the information thus gained, the leading articles in the current issues of the *Atlantic Monthly*, for instance, should be read and discussed.

The written work, one theme a week, gives practice in the principles of structure and the qualities of style. The following list of assignments indicates the nature and amount of the written work: (1) Discussion of a local college problem, (2) Criticism of an existing condition with the proposal of a remedy, (3) Interpretation of the significance of a present day tendency in education, literature, the drama, social life, etc., (4) Discussion of some vague term that needs definition, (5) An explanation involving classification, (6) Analysis of a debatable question, (7) An editorial, (8) A familiar, personal essay, (9) Explanation by means of narration, (10) A biographical portrait, (11) Explanation by means of description, (12) Criticism of a magazine essay, (13) Criticism of a short story, (14) Criticism of a modern play, (15) Criticism of a magazine poem.

Three hours a week for one semester. (3)

5. **Narration and Description.** This course consists of practice in writing the story and related forms of imaginative composition. Such books as the following are suitable for texts: J. B. Esenwein's *Writing the Short Story*, Margaret Ashmun's *Modern Short Stories*, B. A. Heydrick's *Types of the Short Story*, C. S. Baldwin's *Specimens of Prose Description*. Among other excellent text-books may be mentioned W. S. Pitkin's *The Art and Business of Story Writing*, which is unexcelled for advanced students; H. S. Canby's *A Study of the Short Story*, which is mainly historical, with a good collection of specimens; and Bliss Perry's *A Study of Prose Fiction*.

This course should be undertaken only by students who have successfully completed the course in general composition and rhetoric. The teacher should be unremitting in checking careless habits that have persisted, and should insist upon a high standard of correctness in all matter of form and grammar, diction, sentence-structure, and paragraphing. On no account should the intellectual side of imaginative



composition be neglected; hard thinking is needed for the mastery of fundamental laws and technique in the "literature of power," with which the course is concerned, as much as in the "literature of knowledge," which is the special province of the course in exposition.

In the content of the course narration should considerably over-balance description; and of the forms of narration the story may most profitably be taken as central. The story, taken in its broadest sense,—not the technical "Short-Story" invented by Poe, which is difficult and should be brought in, if at all, only at the end of the course,—affords abundant opportunity for the study and practise of all the three ingredients of narration,—action, dialogue, comment; of all the four special story elements,—plot, characterization, setting, and spirit or atmosphere; and room beside for every variety of description. An effective course may indeed be arranged in which the story is the only literary form considered; but it is preferable to use this literary form rather as a nucleus, and to illuminate special aspects of its technique by the simultaneous study of forms more confined in their range. Thus the photo-play will give practice in the invention of narration which is nearly pure action; the anecdote illustrates in miniature the elements of plot-structure; the one-act play or dramatic sketch is composed of action plus dialog, with special opportunities for character-drawing without analysis or description; the descriptive sketch exemplifies setting and characterization, and may be used for drill in every sort of description proper; the personal essay consists of pure comment and analysis; and the lyric poem may convey only spirit or atmosphere. The comparative study and practise of several different forms probably gives the maximum benefit in broadening and stimulating the student's range of reading and appreciation.

The course should comprise theory, example, and practice, example, being more important than theory, and practice more important than either. The theory may be obtained from a text-book, supplemented by lectures. From forty to fifty examples of narration and description, including stories, plays, sketches, photo-plays, and specimens of any other forms studied, may well be required as outside reading during the course. The selection of reading should be governed by the text-book used and by the range of the school library. In the matter of practice, an average of one story or its equivalent in other forms should be required each week; and each one should be reviewed, if possible in personal conference, and revised or rewritten as seems advisable. Much of the efficiency of the course depends on frequent conference with the individual student. For this purpose time may well be spared, if necessary, by reducing the number of the class hours required and replacing them by personal conferences. Three hours a week for one semester. (3).

6. **American Literature.** This course should embrace some study of the beginnings, particularly of the material, social, and intellectual conditions which were the basis of literature in the several centers of English life in this country before and during the Revolution. It may well, also, if time and the library facilities of the college permit, consider the types and tendencies of American literature in the present century. But the central and chief interest of the course lies in what may be called the standard authors, from Franklin to Mark Twain. Sometimes these writers stand alone, like Poe or Hawthorne or Whitman or Lanier; sometimes they constitute groups, like the Knickerbocker group, the Transcendentalists, the Cambridge scholars. In either case they should be studied in their origins and shaping circumstances as representatives of certain aspects of American life and against a background of social, intellectual, moral, and political history. Some of them—Poe, Hawthorne, Emerson, Whitman, for example—should be studied intensively for their intrinsic literary value or as presenting some problem in criticism. The course as a whole should give not only a first hand acquaintance with the major works of American literature but also a right perspective of literature in America as an expression of American ideals.

Much time should be given to outside reading and the preparation of papers. The latter, besides abstracts, analyses, and occasional detailed critical commentaries—of distinctive poems, essays, stories—should comprise a study of some critical or historical problem which will give training in the finding and the first hand use and evaluation of critical material. It is especially important that the student be trained to acknowledge and give exact citations for all material used. Three hours a week for two semesters. (6)

7. **Public Speaking.** This course should include training in voice-production, articulation, pronunciation, natural reading, and oral composition. In voice-training care should be taken to secure purity of tone before exercises are given for the development of volume and force. Drill in articulation should be emphasized and should include individual sounds, hard combination of sounds, and difficult words and sentences. For the study of pronunciation a phonetic alphabet, preferably the alphabet of the International Phonetic Association, should be learned and many exercises written out in the phonetic spelling. To develop naturalness in reading the student should begin with simple colloquial selections as near ordinary talk as possible and pass from these to more didactic prose and then to selections of sentiment and to emotional oratory. Oral reports on topics connected with the course should be frequent. These reports should always be outlined and may often be written out for closer criticism than is otherwise possible. Further oral composition may well be based on topics suggested by

the current numbers of *The Literary Digest* or *The Review of Reviews*, copies of which can be placed in the hands of each student at reduced prices even for limited periods. Toward the end of the course the various types of public address may be studied and original addresses from ten to fifteen minutes in length prepared and delivered. These original addresses should be carefully outlined and written out for detailed criticism, though they need not, perhaps should not, be delivered verbatim in class. Some drill book like Cumnock's *Choice Readings* should be used. Wynans' *Public Speaking*, Pearson and Hicks' *Extemporaneous Speaking*, Lee's *Principles of Public Speaking*, Baker's *Forms of Public Address*, and Foster's *Principles of Argumentation* are useful books for reference. Two hours a week for two semesters. (4)

*For library equipment, see pages 104-110.*

## FRENCH

1. **Elementary French.** French grammar with constant practice in writing and speaking French. Easy French prose. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

2. **Reading, Syntax and Composition.** This course aims to give a good knowledge of the spoken language. Reading from such authors as Mérimée, Halévy, Augier, Bazin, Pailleron, About. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

3. **Advanced French.** Selected masterpieces of French literature, both classical and modern; Corneille, Racine, Molière, Hugo, Sand, Balzac, Daudet, Rostand, etc. Study in very brief outline of the corresponding periods of the literature. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

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The work should be planned so that the three courses will form a continuous whole, the completion of which will fit the student to read ordinary French fluently without translation, to speak and write it with grammatical correctness and some degree of ease, and to understand it from hearing. To this end the work should be oral as far as possible, and careful, unremitting attention should be paid to the pronunciation. Careful attention should be given to the acquiring of a vocabulary, not so much in the form of isolated, detached words, as of connected words and phrases expressing complete thoughts. It is hardly necessary to add that the essentials of the grammar should be thoroughly mastered. The work should give the student some historical knowledge of the literature, some knowledge of the geography of

the country concerned, and a familiarity with the life, thought, and customs of the people.

*For library equipment, see pages 111-113.*

## SPANISH

1. **Elementary Course.** Grammar, reading, conversational practice. It is recommended that special emphasis be laid on Latin-American subject-matter, that grammar be treated chiefly as a helpful short-cut, that practice in the actual use of grammatical principles receive more time than the discussion of theories. The conversational method should be used as much as possible, but not, especially in the earlier stages, at the expense of exact comprehension. From 150 to 200 pages of easy, modern prose should be read. Dictation should be frequent, and a few poems should be memorized as an aid to pronunciation. From the very start, the text read should be made the basis for oral drill, involving short, rapid questions and answers. Among satisfactory texts may be mentioned the following: *grammars*; Olmsted and Gordon's *Abridged*, Holt; Ingraham-Edgren's, Heath; Fuentes and François', Macmillan; Hills and Ford's, Heath: *readers*; Roessler and Remy's *First Spanish Reader*, American Book Co.; Morrison's *Tres Comedias Modernas*, Holt; *Zaragüeta*, Silver, Burdett and Co.; *for composition and conversational practice*, Méras and Roth's *Pequeño Vocabulario*, Heath; Warshaw's *Spanish-American Composition Book*, Holt. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

2. **Reading, Conversation, Composition.** A rapid review of the main principles of grammar should be made simultaneously with the writing of composition work. Spanish should, as soon as possible, become the sole language of the class-room. It is recommended that, in the choice of texts, special attention be paid to those dealing with Latin-America. Between 300 and 400 pages of representative modern prose should be read. Accuracy should be insisted on in everything. Some stress should be laid on literary qualities. Occasional proverbs and poems should be committed to memory for the sake of pronunciation. Some composition work should be done every day. Among books that may be recommended are the following: *grammars*; see Course 1: *readers*; Albes' *Viajando Por Sud América*, Holt; Supple's *South American Historical Reader*, Macmillan; Larra's *Partir a Tiempo*, American Book Co.; Alarcón's *El Sombrero de Tres Picos*, Holt; Harrison's *Spanish Commercial Reader*, Ginn; Pitman's *Spanish Commercial Reader*, Sir Isaac Pitman and Sons, New York; *for composition and conversational practice*; Warshaw's *Spanish-American Composition*

*Book*, Holt; Crawford's *Spanish Composition*, Holt; Nutt's *English-Spanish Conversation Dictionary*, Ritter and Flebbe, Boston; *Boletín de la Unión Panamericana*, Washington, D. C.; *Las Novedades* (a weekly paper), New York. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

3. **Advanced Course.** The rapid reading of Spanish and Latin-American works, with special emphasis on the historical and social aspects of Latin-American life. Constant practice in speaking Spanish and in writing Spanish of some difficulty. Collateral reading of English and Spanish books on Latin-America. Sight translation of excerpts from the Latin-American portions of the *Commerce Reports* (issued daily by the Bureau of Foreign and Domestic Commerce, Washington, D. C.) is recommended. Among satisfactory texts may be mentioned: *for class-room reading*; Nelson's *Spanish American Reader*, Heath; Mesonero Romanos' *Selections*, Holt; Quintero, *Doña Clarines*, Heath; Shepherd, *Latin America*, Holt (to be read not too rapidly, along with other reading, and to be reported on in Spanish): *for composition-work*; Ramsey and Lewis, *Spanish Composition*, Holt; Remy, *Spanish Composition*, Heath: *for outside rapid reading*; see the list of Latin-American books in the library-list, pages 114-115. Three hours a week for two semesters. (6)

*For library equipment, see pages 114-115.*

## GERMAN

1. **Beginning German.** This course should include (1) careful drill upon pronunciation, (2) systematic drill upon the elements of grammar, (3) abundant practice in oral and written reproduction of the text, in memorizing colloquial and idiomatic phrases, and in dictation. As outlined above, all reading in this course should be intensive. If the work is conducted in this manner, there will not be time to study more than the reading selections contained in such a book as Prokosch's *German for Beginners*. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

2. **Reading, Syntax, and Composition.** The course calls for about 200 pages of moderately difficult reading, chiefly prose, with constant practice in oral and written reproduction of selected portions and with review of grammar. About 100 pages from the writings of such authors as Storm, Hauff, Baumbach, Freytag, or from the contents of a book such as Boezinger's *Erstes Aufsatzbuch* should be treated intensively in class study. About 100 pages should be assigned for study outside the class. Dictation should form an important part of this course. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

3. **Advanced Reading.** The reading in class in this course should be of two kinds. The reading of texts of moderate difficulty or of such books as Boezinger's *Zweites Aufsatzbuch* or Boezinger's *Mündliche und schriftliche Übungen* should be continued in order to improve the student's control of oral and written expression. Dictation and free composition based upon this dictation should be stressed. In addition, the student should be introduced to more difficult German prose such as that contained in Evans and Merchaut's *Ein Charakterbild von Deutschland* or in Nichols' *Modern German Prose*. Translation may be used advantageously in connection with this more difficult prose. Outside reading should be continued, and the number of pages assigned for a lesson should be increased. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

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The first three courses in German should be essentially language courses designed to enable the student not only to read German, but also to use the German language effectively as a means of oral and written expression. German should be taught as a living language; it should as far as practicable be the language of the class room. Speaking, reading, and writing should be equally stressed, but each should be used not as an end in itself, but as a means to learning the language. Above all things, thoroughness rather than quantity should be the aim in each course.

**Pronunciation.** If German is taught as a living language, speaking, reading, and writing are inseparable. Fundamental to all three is good pronunciation, which is necessary not only for accurate speaking but also for retention of vocabulary and for mastery of grammatical forms. Drill in pronunciation should be emphasized at the beginning of the first course and should be continued thruout the second and third courses as well as thruout the first. Pronunciation should be placed upon a thoroly rational and phonetic basis. This fact does not necessarily imply that the phonetic alphabet should be taught to the student, but it does imply that the teacher himself should be phonetically minded and phonetically trained. Constant reference to such a book as Viëtor's *Deutsches Aussprachewörterbuch* will do much to make incisive and rational the teacher's own grasp upon pronunciation. If the teacher is phonetically trained he will drive home the difference between German sounds and English sounds, and insist that characteristically German sounds, such as *Umlauts*, the *ch* sounds, and *l* and *r* are correctly pronounced.

**Speaking.** German should be the language of the classroom. Every phase of the class work will then contribute toward the acquisition of ability to speak the language and to understand the spoken idiom.

Grammar should as far as practicable be taught in German. More particularly the reading done in class should afford a basis for intensive discipline in oral composition. The student should be required to give back the entire subject matter in German, either in the form of answers to German questions and repetition from memory, or in the form of free oral composition.

*Reading.* One aim of the first three courses in German should be to have the student read the German text fluently, naturally, and intelligently, without unnecessarily giving time and energy to translating it. Much reading aloud in class under critical supervision of the teacher should contribute to this end. The student needs a good model to follow in this work. The teacher himself should, therefore, frequently read aloud to the class passages upon which he has carefully practiced beforehand. Such reading, when accompanied by the proper kind of training in speaking, develops the syntactical sense requisite for free written composition.

*Collateral Reading.* In the second and third courses additional reading should be assigned for study outside the class. It should be somewhat easier than the reading done in the class, and should form the basis for work in oral and written composition.

*Writing.* The writing, like the speaking, should be based primarily upon the reading. Composition work should include the following: changing the tenses of the verbs in a paragraph, changing from direct to indirect discourse, answering in writing questions based upon the text, reproducing in the student's own words a story read, writing dictated exercises, composing letters, and finally writing entirely free compositions based on topics suggested by the student's reading, which furnishes him the necessary vocabulary and idioms. If this method is used, the student will acquire a better appreciative understanding of the German language and literature than he could acquire by means of mere mechanical translation.

*Translation.* Translation from English into German and from German into English should be reduced to a minimum. Such training as that suggested in connection with the work in speaking, reading, and writing, when drill in synonyms is added, gives the student a better understanding of the meaning of the text and a more accurate control of the language than he could get from translating. Translation is an art. In class work it should be used intensively by assigning selected passages from time to time for written translation into the best English at the student's command.

*Dictation.* Writing from dictation requires the student to master the German sentence. Preparation for it involves review; the exercise itself trains the ear and the eye, and focuses attention upon details

of pronunciation and orthography. Dictation should occupy an important place in all three courses.

*Grammar.* Grammar should as far as practicable be taught inductively in the German language. It should be taught from the point of view of *Sprachlehre* by means of *Sprachübungen*. The first course should attempt to introduce the essential elements of grammar, including drill upon the more difficult parts of grammar, such as the forms of the passive voice, the use of cases with prepositions, with verbs, and with adjectives, the uses of tenses and of modes, word-order, and word-formation. This work should be done thoroughly so far as it goes. If at times it should prove impracticable to cover all the details of grammar suggested, they should be thoroughly drilled in the second course, which is expected to add to the grammar taught in the first. The third course should give also a resumé and synthesis of the grammatical knowledge acquired in the first and second courses.

*For library equipment, see pages 115-121.*

### GREEK

1. **Elementary Greek.** Thoro drill in forms and in the fundamental principles of syntax by daily written and oral exercises. Reading of 20-30 pages of easy Greek. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

The purpose of this course should be to have the students learn the forms and the fundamental principles of syntax as rapidly as is consistent with thoroness and accuracy, so that as soon as possible some easy reading may be begun.

2. **Xenophon's Anabasis.** A thoro review of syntax and of Attic forms. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

In this course a systematic study of the grammar should be made in connection with the text read. This work may be profitably supplemented by weekly translations from English into Greek. In this way the student will acquire a larger vocabulary and will have the grammatical principles more thoroly impressed on the mind.

3a. **Xenophon and Plato.** Two books of Xenophon's *Memorabilia*; Plato's *Apology* and *Crito*. Not merely a translation of the texts, but also a study of Socrates and his philosophy. Three hours a week for one semester. (3)

Effort should be made to have the students acquire an ability to read rapidly. For this purpose frequent practice should be had in translating at sight passages beyond the assignment. The student should read the Greek aloud and endeavor to get the meaning in that



way. In connection with the work in the original the rest of the *Memorabilia* and some other dialogues of Plato might be read privately by the students in translation. They would also read with interest *The Myths of Plato* by Stewart, London, 1905, and a brief history of philosophy such as may be had from Mayor's *A Sketch of Ancient Philosophy from Thales to Cicero*.

4b. **Homer.** Reading of four or five books of the *Odyssey* or the *Iliad*, with special attention to reading metrically. Three hours a week for one semester. (3)

The dialect should be learned at once. This may be done most effectually from the text assigned from day to day by the teacher. Each dialectic form should be explained and the corresponding Attic form given. The students should be encouraged to read in addition to the class work the remainder of the poem in English translation. For this purpose Palmer's *Odyssey* and Lord Derby's translation of the *Iliad* are recommended.

5. **Classical Mythology.** The myths as they are represented in Greek and Latin literature and in art. Recitations and illustrated lectures. Two hours a week for one semester. (2)

The students should be encouraged to read widely in translation Greek and Latin authors whose works contain the classic myths. The lectures should be illustrated as fully as possible by representations of works of art.

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Text-books such as the following for the courses above are suggested:

1. Ball's *Elements of Greek*, Macmillan; White's *First Greek Book*, Ginn; Gleason's *Gate to the Anabasis*, Ginn; Moss' *First Greek Reader*, Allyn and Bacon; Colson's *Stories and Legends*, Macmillan.

2. Mather and Hewitt's *Xenophon's Anabasis*, American Book Co.; Goodwin and White's *Xenophon's Anabasis*, Ginn; Smith and Bonner's *Xenophon's Anabasis*, D. Appleton; Goodwin's *Greek Grammar*, Ginn; Hadley-Allen's *Greek Grammar*, American Book Co.; Pearson's *Greek Prose Composition*, American Book Co.

3a. Smith's *Xenophon's Memorabilia*, Ginn; Winans' *Xenophon's Memorabilia*, Allyn and Bacon; Dyer's *Plato's Apology and Crito*, Ginn; Kitchel's *Plato's Apology and Crito*, American Book Co.

4b. Seymour's *Homer's Iliad*, Ginn; Perrin's *Homer's Odyssey*, Ginn; Sterrett's *Homer's Iliad*, American Book Co.

5. Gayley's *Classic Myths*, Ginn; Guerber's *Myths of Greece and Rome*, American Book Co.

*For library equipment, see pages 122-124.*

### LATIN

1. **Cicero's Orations.** Open to students entering with two entrance units in Latin. Selected orations and letters of Cicero; training in syntax and in the forms of the language. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

2. **Virgil's Aeneid.** Open to students entering with three entrance units in Latin. Study of subject matter, forms, prosody, and syntax. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

3. **Cicero's Essays on Friendship and Old Age.** Open to students who have taken course 1 or who presented three units in Latin for admission. Careful review of forms and syntax by means of writing in Latin short sentences which involve the vocabulary and the constructions of the Ciceronian text. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

4. **Livy and Horace.** Open to students who have taken course 3 or the equivalent. The war with Hannibal, Books XXI or XXII, and selections from Horace. The geography of the ancient world. Three hours a week for two semesters. (6)

5. **Elementary Course in Latin Prose Composition.** Open to students presenting three units for admission. The writing of paragraphs; oral work on short sentences. One hour a week for two semesters; or, preferably, 2 or 3 hours a week for one semester. (2) or (3)

*For library equipment, see pages 124-132.*

### MATHEMATICS

1. **Trigonometry and Algebra.** Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

It is preferable, but not necessary, that at least part of the college algebra precede the trigonometry. Most of the more recent texts in trigonometry and college algebra are acceptable. In view of the limitation in time and the large amount of available material, certain omissions from the ordinary texts are suggested, not because the material is not valuable, but because it may better be postponed to later courses.

*College Algebra.* The algebra part of this course should begin with a rapid review of elementary algebra. This review should be conducted with reference to the gaining of a thoro knowledge of the fundamentals with simple problems. The fundamental assumptions should be thoroly understood thru the use of concrete illustra-

tions rather than in a formal logical way. The mechanical operations, such as long division, symbols of aggregation, the simpler cases in factoring, and simple and complex fractions, should be thoroly reviewed.

The solution by elementary methods of linear equations in one unknown and pairs of simultaneous equations should be reviewed. The meaning of the graph in representing statistical data should be studied, and the graphical solution of simultaneous equations in two unknowns should be illustrated by a few simple problems, including the case where the lines are parallel. Thruout the course the graph should be used to throw light on the meaning of the equations and of the algebraic processes rather than as a practical method of solution. Determinants of the second and third order should be studied with a suggestion as to the meaning of determinants of higher order. The case where the lines are parallel or coincident, in which the determinant of the coefficients reduces to zero, furnishes a clear illustration of the impossibility of dividing by zero.

The simpler operations with radicals of the second degree should be thoroughly mastered, with special emphasis on negative and fractional exponents. The complete study of exponents, however, is taken up to the best advantage in connection with logarithms, and the topic should be reviewed, at least, when logarithms are taken up.

The solution of quadratic equations by completing the square and by the formula should be reviewed. Graphical solutions and applications to concrete problems should be emphasized. The case where there is only one or no real solution and also the meaning of negative solutions may be illustrated graphically and by concrete problems such as that of a body thrown vertically. Radical equations may be treated but need not be emphasized. They furnish the best illustration of equations which are not satisfied by one of the answers obtained by formal processes.

Simultaneous quadratic equations should be illustrated by a few simple cases treated graphically, but a large amount of graphical solution is not desirable at this stage, as it is not the practical method. The special methods treated so extensively in most text books are not important, as they apply to only a very limited class of problems.

Arithmetic and geometric progressions should be treated. Only the necessary fundamental formulas need be used. Applications should be made to averages, compound interest, and annuities. The infinite series may be omitted.

Permutations, combinations, and probabilities should be studied. Only the simplest fundamental formulas should be used, emphasis being put on securing a clear understanding of the situations.

Mathematical induction may be omitted as a topic, but the method should be used where it is helpful in special proofs.

The binomial theorem for positive integral exponents may be proved by mathematical induction or by the use of combinations. Chief emphasis should be placed on the use of the theorem itself.

Only the simplest formal treatment of complex numbers should be attempted. The square root of minus one should always be replaced by the letter  $i$ , and this can be worked with in all respects as any other algebraic quantity. No other principles are necessary. The graphical representation of complex numbers should not be treated at this stage, as students tend to confuse it with the ordinary graphical representation. In all junior college work it is recommended that students be told that complex numbers have important uses in higher mathematics but that they have no useful applications at present. They may be entirely omitted from the course without harm except for purely formal work. If this is done, when the graph of an equation does not show a root, the student may be told that the equation has no real root, and the study of the imaginary roots may be postponed to a later course. De Moivre's theorem should be omitted.

Equations of the third degree and higher may be solved by estimating the root, substituting in the equation, plotting points on the graph, and repeating this process, each time getting a closer approximation. Answers should be accurate to two or three significant figures. Attention should be called to the fact that the computation is wholly arithmetic and that the graph is merely suggestive. No such formal scheme as that called *Horner's process* is desirable at this stage. The usual formal schemes and rules are objectionable in this course as they tend to obscure the real issue. They may be useful to the experienced mathematician in saving time, but are objectionable for the beginner.

Inequalities may be treated briefly. Partial fractions and infinite series should be omitted.

Owing to their great importance logarithms should be treated in connection with algebra and in connection with trigonometry. Close connection should be made with the complete treatment of exponents. Extensive practice should be given in making numerical computations of all sorts, including compound interest, annuities, progressions, etc., by means of logarithms. The student should not be permitted to gain the impression that logarithms are useful only in trigonometry. The slide rule should be treated as a special form of logarithmic table. The college should own at least one good slide rule. If possible each student should own an inexpensive one. A very satisfactory slide rule for the use of students can be made in the department of manual arts with the use of a sheet of ordinary logarithmic paper. A slide rule about four feet long for use in the class is very useful. This can be made with very little expense in the Manual Arts department. The use of tables should be emphasized, such as simple and compound interest

tables and tables of squares and cubes and square roots and cube roots. Interpolation should be thoroly studied with all tables used.

Variation should be studied as another language for proportion. The expression *varies as* is widely used in the sciences and should be made familiar by working a large number of problems. This form of representing proportion may largely displace the traditional form. The idea of variation should not, however, be limited to simple proportion, but should be extended so that the student acquires the general idea of the dependence of one quantity on another. This idea of dependence of one quantity on another, or functionability, should be made prominent throughout the course.

*Trigonometry.* The connection of this work with geometry should be made through solving right and oblique triangles by constructing them to scale with ruler and protractor, and by measuring the desired parts. This method should be kept up as a check on later work. Reality may be given to problems by requiring students to determine inaccessible distances. It should be noticed that no new ideas are necessary for this work, as it can be done equally well in a geometry class.

Definitions of the trigonometric functions should be given in a form which is equally applicable to all angles, although attention need not at first be called to the functions of angles greater than ninety degrees.

The solution of right triangles should be carried out first by the use of the natural functions. The premature use of logarithms prevents the student from getting clear notions as to the meaning of the trigonometric functions. Use should be made of the Pythagorean theorem and tables of squares. A serious study of tables in general should be made, including the natural functions, logarithms, and tables of squares. Interpolation should be studied thoroughly. It is highly important that the student become accustomed to the use of tables of various forms. If possible they should become accustomed to the use of three place, four place, and five place tables, with occasional use of seven place tables, which should be accessible in the library. Four and five place tables are adequate for most uses.

The question of the degree of accuracy is important. The student should be taught to know when a graphical solution will be adequate, when four place tables are adequate, when five or seven place tables are necessary, and when it is not desirable to carry results to a large number of decimal places. The slide rule should be used when possible. Trigonometry furnishes the one place in mathematics where thorough training in numerical computation can be most effectively given. The greatest possible use of this opportunity should be made. Systematic arrangement of computations, freedom from mistake in numerical work, and reasonable speed should be insisted on. For most

students this will form the most practically useful part of their course. Computation problems should always be checked.

After right triangles have been mastered, angles greater than ninety degrees should be studied. Special angles, the relations between functions of one angle, and the plotting of the graph of the functions should be taken up. Such other applications as projections, and composition and resolution of forces give meaning to the functions of larger angles and should not be slighted. The crucial part of trigonometry is a clear knowledge of the definitions of the functions for all angles, and the relations between the functions of large angles and the functions of acute angles.

In the solution of oblique triangles the chief stress should be placed on the solution by dividing into right triangles. With the use of the Pythagorean theorem and tables of squares, logarithms where convenient, and one very simple algebraic process, all cases of oblique triangles can be solved by means of right triangles practically as easily as by the complete logarithmic method. The student sees the meaning of every step in the process, and with reasonable drill is not likely to forget it. The complete logarithmic processes are theoretically much more intricate and are much more likely to be forgotten. Thoroughness at this point should not be sacrificed in order to gain a larger variety of methods. The sine and cosine laws should be taught in this connection as a more compact method of doing the same thing that is done by dividing into right triangles.

The traditional solution by logarithms, using the law of tangents and the laws for half angles may then be taught, but it should not be allowed to overshadow the method by dividing into right triangles.

The fundamental addition formulas for sines and cosines should be very thoroly mastered. Students should see that they can derive all the other formulas involving two angles from these, and have ample drill in doing this. Care should be taken that this work is intelligent and not mere mechanical juggling. The number of formulas to be memorized should be kept to a minimum, and these should be very thoroly mastered.

Some of the simpler trigonometric equations should be studied, but the more complicated ones should be avoided. Such other topics as radian measure and inverse functions may be treated briefly without complicated exercises.

Such advanced topics as De Moivre's theorem, infinite series, and the accurate computation of the trigonometric functions should be omitted. Spherical trigonometry should, in general, be omitted and the time gained be devoted to making the student proficient in computation and in the mastery of the fundamental principles. Spherical trigonom-

etry is useful only in certain very specialized applications and can best be learned when needed.

2. **Analytic Geometry.** Plane and solid analytic geometry and introduction to the calculus. Prerequisite, trigonometry and college algebra. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

Owing to the fundamental importance of rectangular coordinates, they should be explained as though the students had never had them. Oblique coordinates should be omitted.

Formulas for the distance between two points, the division of a line in a given ratio, and the area of a triangle should be studied; and simple theorems from plane geometry should be proven analytically. Polar coordinates and the relations between polar and rectangular coordinates should be explained, and some of the simple cases of equations in polar coordinates should be plotted by points, but all complicated work in polar coordinates may be omitted.

While analytic geometry is an effective means for the study of geometrical figures, it is much more important for the student to recognize that the geometric figure and the equation are both a means of representing and of studying actual quantities of various sorts, as statistical and experimental data. As a beginning in this the representation and interpretation of the values of related quantities by a graph should be emphasized.

The straight line should be studied exhaustively. In this study the slope should be made the basic idea. This should be interpreted as a rate of change. All the standard forms of the equation of a straight line should be familiar, being studied by the actual manipulation of numerical problems rather than by the application of formulas. The solution of simultaneous linear equations should be connected with the intersection of two lines. Such other relations as the angle between two lines, and the distance of a point from a line should be studied.

The circle, parabola, curves representing polynomial equations, the ellipse and the hyperbola should be taken up separately and studied quite thoroly. The work on polynomial equations should be connected with the solution of higher equations in one unknown. The ideas of tangent to a curve, the slope of a curve, and the derivative of a function should be introduced together at this point. Tangents should be dealt with by the calculus method, or such a modification of it as will lead the student gradually to the point of view of the calculus.

The general definition of a conic should be given. The student should see clearly that an equation of the second degree represents a conic, and that the circle, the parabola, the ellipse and the hyperbola and two lines are special cases. He should be able to draw these curves

directly from the definition, and recognize that they can all be formed as the section of a cone. If the separate special cases have been studied thoroly, the general equation of the second degree need not be studied exhaustively. In particular, the traditional work on the removal of a term in  $xy$  is not vital, and should not be emphasized.

Some special curves other than conics, such as the sine curve, the logarithmic curve, the cycloid, and a few others should be included.

Emphasis should be placed on the determination of the equation of curves from a set of data such as would be obtained in a laboratory. Some other forms of coordinate paper, such as logarithmic paper, should be used.

The fundamentals of solid geometry, which are more important than the more advanced parts of plane geometry, should not be omitted, but the treatment may be brief. Corresponding to the slope of a line in plane geometry, the notion of direction cosines is the most important single idea, and should be thoroly mastered. The fundamental forms for the equations of a straight line, a plane, a sphere, and a few isolated examples of quadric surfaces should be understood. The general equation of the second degree need not be studied, tangent planes and lines and the general rotation of the axes may be omitted. Students should be familiar with the meaning of one equation, a pair of equations, equations representing cylinders and projecting planes, and plotting surfaces by contour lines. Thruout this work attention should be called to the analogies between plane and solid geometry.

**3. Differential Calculus.** Prerequisite, analytic geometry. The standard course is five times a week for one semester. A shorter course may be given three hours a week for one semester. (5) or (3) (See remarks under course 4.)

**4. Integral Calculus.** Prerequisite, differential calculus. The standard course is given five times a week for one semester. A shorter course may be given three times a week for one semester. (5) or (3)

The names differential and integral calculus do not accurately describe these courses. The modern tendency is to give some integration in the differential calculus, and to reserve some of the more difficult topics, such as Taylor's theorem, for the second course. Any standard text will indicate about the amount to be covered in the two five hour courses. If the two three hour courses are given, the more difficult topics should be omitted, but some differentiation and some integration should be included.

Besides the application to curves and surfaces, applications to physics, mechanics and other sciences should be emphasized. The fundamental idea that the calculus is a study of rates of change should be kept in the fore ground. Special care should be taken in the selection of a text to avoid a purely formalistic book.



The main consideration in planning the course in calculus is not to allow the work to degenerate into the mere memorizing of formulas of differentiation and of integration. To make the work genuinely significant to the student means serious work on the part of the teacher, but unless this can be done it would be better not to offer the course.

The suggestions given above with regard to the organization and conduct of courses in mathematics are not intended to restrict the freedom or initiative of the teacher. The choice of text and the detailed order of topics are entirely secondary in importance to the spirit in which the work is conducted. Especially in the case of students who are to go into higher courses, the general attitude, breadth of view, and clearness of thought of the student are of first importance. With proper maturity of thought on the part of the student, deficiencies in the details of subject-matter can easily be made up in higher courses.

It is assumed that the teacher will use one of the current standard text-books. When such a book is adopted, the presumption is that the teacher will not depart widely from the order or method of the text except for good reason. In so far as the teacher has a real mastery of the subject, he will, however, feel free to modify the course as given in the text-book. The teacher should not feel under obligation either to take up every topic given in the text-book or to have the student solve every problem under the topics that are taken up.

*For library equipment, see pages 133-138.*

## PHYSICS

1. **Elementary Physics.** This course is intended to cover in an elementary manner the general principles of physics. Special emphasis should be given to mechanics and heat with some work in electricity and magnetism and certain selected topics from the other divisions of physics. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

2. **General Physics.** This course is intended to supplement course 1 so that the two courses together will form a fairly thoro course in general physics. Trigonometry is required for admission to this course. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

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Course 1 should have two aims, first that the student acquire a working knowledge of the broad fundamental principles of physics, and second, that he learn the *methods* of thinking used in physical science. The teacher should understand that he is teaching not only physics, but also the methods of modern science.

The subject-matter of course 2 may overlap that of course 1 to an amount to be determined by the teacher's judgment. Large numbers of problems should be given in course 2, especially in mechanics and electricity. In mechanics the student should learn the use of the British Engineering, as well as the C. G. S. system of units. It is expected that students who have finished course 2 will be able to enter technical courses in engineering.

If the work of course 1 is given in one semester, it is suggested that there be two laboratory periods of two hours each a week and three recitation periods. In course 2 the amount of laboratory work may be less than that of course 1. In no case should there be more time spent in the laboratory than in the study of the text-book.

For course 1 a book similar in grade to Spinney's *Text-Book in Physics*, Macmillan, should be used. It is possible to use the same text for course 2 if the text is supplemented by outside problems and reading. For example, the student might be required to read S. P. Thompson's *Elementary Lessons in Electricity and Magnetism* (Seventh edition) Macmillan. In course 1 an attempt should not be made to complete any one text. It is much better to spend more time on the fundamentals.

For the laboratory some manual of college grade should be used. For course 1 a manual equal in grade to a *Laboratory Manual of Elementary Physics*, published by the University of Missouri and in course 2 one equal to *Laboratory Instructions, General Physics*, published by the University of Missouri should be used. The student should keep a careful note-book record of the laboratory work performed. He should not, however, be encouraged to spend much time on mere clerical work.

In both courses the subject matter in the text should be illustrated by frequent, well-selected demonstration experiments. Class demonstrations by the teacher are often more helpful to the student than hours spent in the laboratory. A partial list of apparatus for demonstration work is given on pages 69-71.

*For laboratory equipment, see pages 69-71.*

*For library equipment, see pages 138-139.*

## CHEMISTRY

1. **Elementary Inorganic Chemistry.** This course consists of laboratory work, written exercises, problems, and recitations accompanied by class-room demonstrations. The fundamental laws and theories of the subject are emphasized in connection with a study of typical elements

and compounds. The class-room work follows some standard text-book of college grade. The laboratory work constitutes an important part of the course. The laboratory experiments illustrate the different kinds of chemical changes, properties of typical elements and compounds, and include a study of solutions, ionization, and practice in identification, based upon chemical characteristics previously determined, of substances whose composition is unknown to the student. The definiteness of chemical processes is demonstrated by a number of quantitative laboratory experiments. Five hours a week for one semester or three hours for two semesters. (5) or (6)

2. **Inorganic Chemistry and Qualitative Analysis.** Prerequisite, course 1 or its equivalent. A continuation of course 1 with special reference to the chemistry of the metallic elements. The laboratory work may well consist of systematic qualitative analysis, and should include practice in the analysis of various substances the composition of which is unknown to the student. A study of the more important properties of the principal acids and bases will naturally constitute an important phase of the class-work on the metallic elements. The laboratory work will offer numerous examples of reactions to which the fundamental principles studied in course 1 can be applied, especially the law of mass action, chemical equilibrium, reversible and irreversible reactions, ionic concentration, etc. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

3. **Elementary Organic Chemistry.** Prerequisites, course 1 or its equivalent. An introductory study of the compounds of carbon designed for students who wish a brief survey of the subject; lectures, recitations, and laboratory work. The laboratory work includes a comparative study of the physical and chemical properties and relations of the more commonly occurring organic substances. This course should precede or accompany courses in home economics dealing with foods and chemistry of the household. Three hours a week for one semester. (3)

*For laboratory equipment, see pages 71-73.*

*For library equipment, see pages 139-140.*

## BOTANY

1. **General Botany.** A study of the morphology and physiology of plants representing the main groups of the plant kingdom with special emphasis upon the evolution of plants and the principles of heredity. Five times a week for one semester, or three times a week for two semesters. (5) or (6)

The course in botany should emphasize the fundamental principles of physiology and morphology. The work should be divided, on the basis of five times a week, into three laboratory periods and two recitations, and on the basis of three times a week for two semesters, into two laboratory periods and one recitation. The work should cover the general field of botany, but an intensive study of certain subjects should be taken up rather than a general survey of a large number of topics. It is well to begin with the physiology of the seed plants, bringing in as much of structure as is necessary to make clear the functional aspect. For this a knowledge of representative plant cells, as the *Elodea* leaf cell or cell of the trichome of the squash, is necessary. The following topics should be considered: absorption of water and the structure of the root; the conduction of water and the structure of the stem; photosynthesis, transpiration, and the structure of the leaf; foods, digestion, translocation, and storage; respiration and fermentation; growth (including secondary thickening); irritability, or the response of the plant to its environment; nuclear and cell division.

In this part suitable experiments should be carefully planned and the individual student, so far as possible, should be required to carry them out in a satisfactory manner. A careful record of observations should be made. The work requires an adequate supply of living plants. This preliminary work should then be followed by the study of a selected series of forms. Care must be taken not to use so many forms that each cannot be studied adequately. The selection of forms can be varied to suit the particular requirements of the laboratory. The following is a suggestive list: *Pleurococcus*, *Spirogyra*, *Oedogonium*, *Fucus*, bread mold, powdery mildews, wheat rust, mushroom, liverwort, moss, fern, *Equisetum*, *Selaginella*, pine and angiosperms. In connection with the angiosperms, the general appearance, floral structure, and fruits and seeds of several of the larger families should be included, thus serving as an introduction to classification. Representatives of such families as the rose, legume, crowfoot, crucifer, lily, grass, composite, mint, etc., should be included.

In all the work, the laboratory study of the plant should precede text-book study or class discussion. In the laboratory study, careful drawings and notes should be made. So far as possible, living material of the various plants should be available. For certain stages, however, preserved material is necessary. In addition to the regular material required, as much additional illustrative material as possible should be on hand. This material can be greatly increased from year to year. Specimens of various plants such as fungi, ferns, seed plants, etc., can be prepared and displayed in the laboratory.

The laboratory should preferably receive illumination from the north, and the tables should be placed so that each student can secure

satisfactory light. For keeping living plants and for carrying out certain experiments, a room with southern exposure is necessary. One can provide a large glass box adjacent to a window with southern exposure and in this can grow satisfactorily any of the materials required for the course. A good substitute for charts is a baloptican.

The selection of a text-book and laboratory guide should be made by the individual teacher to suit the requirements of the particular course given.

**2. General Bacteriology.** This course should include the fundamental principles of bacteriology. Laboratory work on the microscopical and cultural characteristics of various organisms should include the methods of staining bacteria, the preparation and sterilization of media, the isolation and cultivation of bacteria, the influence of the environment upon the growth of bacteria, the characteristic changes produced by bacteria in the medium upon which they are grown, and the simple laboratory analyses of air, water, milk and the soil. The class work should include a discussion of the morphology and physiology of the bacteria, with special emphasis upon the relation of bacteria to the fermentation of organic substances, the rôle of bacteria in the soil, and the relation of micro-organisms to disease in plants and animals. Such books as the following are suitable for texts: Buchanan's *Household Bacteriology*, Conn's *Bacteria, Yeasts and Molds in the Home*, Conn's *Agricultural Bacteriology*, Frost and McCampbell's *General Bacteriology*, Giltner's *Laboratory Manual of Micro-Biology*, Jordan's *General Bacteriology*, Lipman's *Bacteria in Relation to Country Life*, Marshall's *Micro-Biology*, Reed's *Laboratory Manual of Bacteriology*, and Russel and Hastings' *Dairy Bacteriology*. Three hours a week for one semester. (3)

*For laboratory equipment, see pages 73-82.*

*For library equipment, see pages 140-144.*

## ZOOLOGY

**1. General Zoology.** The purpose of this course should be to present the fundamental facts of zoological science in such a way that the student will be led to an appreciation of the biological point of view and of the scientific method used. The forms examined should be considered as illustrating general zoological phenomena rather than as special examples of some phylum. It is not necessary that a large number be chosen, but each one should be examined in considerable detail. A plan of study which can be put into operation advantageously in most classes because it does not offer serious difficulties either in

the types selected or in the securing of qualified teachers, is as follows: (1) The frog, with special reference to vertebrate anatomy, physiology, development and cellular structure; (2) the protozoa—amoeba, paramoecium, and euglena—with reference to their unicellular organization, physiology, life-cycles, and the relation of micro-organisms to disease; (3) the hydra, as an example of a simple metazoan and for comparison with the preceding types; (4) a form of intermediate complexity—earthworm, crayfish or fresh-water mussel—for the purpose of illustrating the structure and activities of an animal having a complex organization but being quite different from the familiar vertebrate; (5) one or more insects, with emphasis upon adaptation, ecology, life-cycles, animal intelligence, and evolutionary problems; (6) lectures, text and reference readings, accompanied so far as possible by demonstration of laboratory and museum material, upon cytological phenomena, the ontogeny of the higher vertebrates, the theory of evolution, and genetics. For such a course Parker and Parker's *Practical Zoology* may be used or Holmes' *The Biology of the Frog*, together with Hegner's *Introduction to Zoology*.

It is not necessary, however, that the course follow exactly these lines, since there is no common practice in the matter of introductory zoology. If a teacher is familiar with the course outlined in Needham's *General Biology* or in Linville and Kelly's *Text-Book of General Zoology*, it may be well to follow the scheme presented in one or the other of these volumes. In any case, however, adequate laboratory work should be given. This course may be given five times a week for one semester or three times a week for two semesters. (5) or (6)

2. **Advanced Zoology.** The nature of this course should be determined by the training and inclinations of the teacher even more than course 1. Where the course in general zoology follows the outlines detailed above, a good second course may be given with Linville and Kelly's *General Zoology* supplemented by such works as Thomson's *Outlines of Zoology*, Hertwig's *Manual of Zoology* and Hegner's *College Zoology*. Such a course should consist of lectures, laboratory work, and field studies, and should be designed to present a general survey of the animal kingdom with intensive study of representative forms of the principal phyla. The emphasis should be laid upon the protozoa, the mollusca, the arthropoda, and the vertebrata. Each phylum should be studied in respect to its distinctive characteristics, consideration being given to morphological, physiological, ecological, and developmental aspects. Wherever possible, attention should be called to the results obtained from recent experimental studies.

An alternative second course which might be given is one in comparative vertebrate anatomy, including a brief study of the embryology of birds and mammals and giving special emphasis to the conception of

evolution. If a teacher were thoroughly prepared, the second course might be developed along ecological lines, with special emphasis upon birds, insects, and the local fauna. Five times a week for one semester or three times a week for two semesters. (5) or (6)

*For laboratory equipment, see pages 83-86.*

*For library equipment, see pages 144-150.*

## PHYSIOLOGY

1. **Elementary Physiology.** This course is intended for students who desire a general knowledge of the physiology and personal hygiene of the human body. It is designed to give the student drill in the scientific methods for the study of biological problems, to teach him to observe physiological phenomena, and to develop his ability to make deductions from complicated functional data. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

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It is recommended that the course in physiology when given for one semester consist of three lectures and two double laboratory periods a week. If the course extends through the year, two lectures and one laboratory period a week should be given. The laboratory work may be based in part on dissections introduced as preliminary preparation for physiological experiments. Also, some well-selected work in histology may be used for preparation work. The strictly physiological experiments are designed always for illustrating principles that hold in the functional behavior of the different mechanisms in the human body. The lower animals such as the frog and turtle retain their vitality very well under laboratory conditions, and should, therefore, serve as the major experimental material. Certain experiments can be formed on the human body, such as the determination of heart rate, pulse, blood pressure, movements of respiration, etc. Even in an elementary course a few experiments on mammals under anesthesia should be demonstrated to the laboratory class as a whole. Detailed laboratory experiments should include the following: muscle irritability, simple and tetanic contractions, nerve irritability, fatigue of muscle, of nerve, influence of temperature on contractility, voluntary muscle fatigue on the human body; the microscopic appearance of the blood, count of blood corpuscles, influence of artificial solutions on blood corpuscles, blood coagulation, the appearance of fibrin, anticoagulants; blood pressure, capillary pressure, capillary circulation, nerve control of small arteries, heart rate, heart sounds, pulse, change in heart rate with body position and with exercise, nervous control of the heart

including the augmentary nerves and inhibitory nerves, change of volume in an organ produced by change of blood supply; respiratory volume, character of expired air, respiratory movements and their nervous regulation, influence of carbon dioxide on respiratory movement; the motility of the alimentary canal including the movements of swallowing, the stomach peristalsis and its nerve control (frog), and peristalsis of the intestine; the secretion of saliva and its nerve control, of gastric juice, of pancreatic juice; the artificial digestion of starches and proteins by the different digestive secretions with chemical tests for end products; tests of the quantity and reaction of the daily output of urine, tests of uric acid, for urea, and for sugars and proteins as pathological constituents; demonstration of reflex action in a reflex frog or a reflex wasp or fly, the decerebrate frog and pigeon; localization of touch, cold and heat stimuli in the skin, tests for the organs of equilibrium, the limits of hearing, a rather complete study of physiology of the eye including tests for the near and far limits of vision, astigmatism, the light reflex, the limits of the visual field, color blindness, color after-images, acuteness of vision for each eye, binocular vision and extra-ocular coordination.

*For laboratory equipment, see pages 86-88.*

*For library equipment, see pages 150-151.*

### GENERAL PSYCHOLOGY

**General Psychology.** The purpose of this course should be to set forth clearly and systematically the main facts and principles of normal conscious processes, their nature, modes of operation, and development. It is advisable to adopt the biological point of view thruout the course, and to emphasize the functions of the mind rather than its structure.

This course should include a brief study of the nervous system and of the relation of mental processes to neural activity. Sensation, perception, concepts, memory, imagination, attention, judgment, and reasoning should be treated thoroly and systematically. Reflexes, instincts, habits and the laws of habit formation should be studied in detail. Special attention, also, should be given to feeling, the nature of emotion, volition, interest, effort, and the consciousness of self.

The lecture and recitation should be supplemented with as much experimental work as time and laboratory equipment will permit. Many group experiments may be performed in connection with the regular class work. There are now available several elementary laboratory manuals such as Langfeld and Allport's *An Elementary Laboratory*



*Course in Psychology*, or Seashore's *Elementary Experiments in Psychology*, the use of which requires very little apparatus.

It will be found helpful to use a good text, such as Angell's *Psychology*, Holt; Pillsbury's *Fundamentals of Psychology*, Macmillan; Titchener's *A Text-Book of Psychology*, Macmillan. Five hours a week for one semester. (5)

*For library equipment, see pages 151-153.*

## SOCIOLOGY

1. **Elementary Sociology.** An introduction to the scientific study of social problems. The first part of the course should consist of a study of fundamental social problems such as the bearing of evolutionary theory and of modern psychology upon social problems, the origin and historical development and present condition of the family, the growth of population, including birth and death rates, the immigration problem, the negro problem, the growth of cities, the social conditions of urban life and of rural life, the social aspects of education, and radical social movements such as socialism. For this first part of the course, a text such as Ellwood's *Sociology and Modern Social Problems*, revised edition, should be used. The second part of the course should specialize upon problems of social welfare, particularly with reference to the dependent, defective, and delinquent classes. For this section of the work a book such as Warner's *American Charities* should be used as a text and a book such as Devine's *Misery and Its Causes* should be used for collateral reading. In junior colleges for women the study of problems of child welfare should be given a large place in this second part of the course. A book such as Mangold's *Problems of Child Welfare* could be used with advantage as a text in this connection.

It is especially recommended that students be encouraged to debate present social problems, as the immigration problem, the negro problem, and the like. Various encyclopedias will furnish material of this nature, especially Bliss' *Encyclopedia of Social Reform*. Five hours a week for one semester or three hours a week for two semesters. (5) or (6)

*For library equipment, see pages 153-154.*

## POLITICAL SCIENCE

1. **American Government.** This course should come in the second year of the junior college curriculum. Students should have a prepara-

tion for this work in a college course in history, the general course in European History satisfying the requirement. In the case of students who come to college with four units of credit in history from an approved high school the requirement of a course in college history may be omitted.

The course in American government should include a comprehensive survey of federal, state, municipal, and rural local government, and should emphasize functions as well as structural aspects of the subject. The study of government ought also to reveal its dynamic character, its constantly changing and evolving form and function. The underlying forces and influences which play upon the various organs of government must be understood. To understand these forces and influences requires a careful study of parties, their influence, methods, and place in our governmental system. Reform movements, such as the short-ballot movement, commission form of city government, and efficiency and economy in administration, should receive due attention. Social and economic tendencies which require governmental action for their realization ought likewise to be given consideration. If these various phases of the subject are properly handled, and the course of current events is constantly drawn upon by the teacher for illustration, the subject can be made of great interest. A book such as Beard's *American Government and Politics* should be used as a text.

The work in American Government should include class discussions and lectures by the teacher upon the basis of the text and supplementary reading. Students should be required to do a considerable amount of reading in addition to reading the text-book. For this purpose the college library should be supplied with a working collection of standard treatises and reference works on American government. Such great classics as Bryce's *American Commonwealth* should become familiar to every member of the class. Frequent short written quizzes are advised as insuring fidelity in this work. There should also be required, if the library facilities are adequate, a written essay upon some special topic which each student is individually assigned, and in the preparation of which he receives individual assistance and guidance by the teacher. Such essays should represent a considerable study of the entire literature of the subject, with special emphasis on the sources, such as statutes, judicial decisions, reports of officials and departments, etc. They should be prepared with care, and should include an outline of the subject as treated in the body of the essay, a full bibliography of all books, articles, and other material used in its preparation, and careful foot-note references.

Five hours a week for one semester or three hours for two semesters. (5) or (6)

*For library equipment, see pages 154-158.*

## PHILOSOPHY

1. **Elementary Logic.** This course should include the principles of both deductive and inductive reasoning. Special attention should be given to the criticism of arguments and the detection of fallacies. Problems should be assigned the class almost daily and their solutions presented not only in oral recitations, but in writing. Such problems will be found appended to nearly all the logic texts. Frequent oral and written reviews are necessary. The student requires constant individual attention and should be trained from the first in precise statement and thoroughness in the mastery of the text. Among the serviceable texts are those of Creighton, Jevons, Hibben, and Sellars. Three hours a week for one semester. (3)

2. **Ethics.** In this course, emphasis should be placed upon (1) the chief problems of ethical theory and the relation of these problems to one another; (2) the principal solutions that may logically be offered to these problems; (3) illustrative material selected from the systems of the great historic theorists, such as Aristotle, Plato, the Epicureans, the Stoics, Kant, Mill, and Spencer; (4) ethical theory concretely applied to the typical problems of the individual and to the society of present day civilization. Among the texts serviceable in this elementary course are those of Drake, Mackenzie, Wright, Paulsen, Seth, and Thilly. Dewey and Tufts is excellent, but a little more difficult for immature minds. For reference to the history of ethics, Rand's selections in *The Classical Moralists*, as well as Sidgwick's *History of Ethics*, will be found useful. Three times a week for one semester. (3)

*For library equipment, see page 158.*

## HISTORY

1. **European History.** History of Europe during the mediaeval and modern periods, dealt with in as broad and comprehensive a manner as is consistent with thoroughness of knowledge and definiteness of outline. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

2. **English History.** Political, social, and institutional development of the English people from the earliest times to the present day. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

3. **American History.** History of the United States with special emphasis on the period since 1760. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

Junior college work in history should be introduced by a general course in European history, which should cover the period from about 400 A. D. to the present time. This course should be followed by more advanced work in American or English history. Because the students should have an adequate knowledge of the history of their own country, American history is preferable to English history for the second course in the junior college. Whatever English history is needed to give the students an understanding of the beginning of American institutions may be studied in European history or as a introductory part of the course in American history.

Each history course should be based upon a text-book of college grade and should include advanced collateral readings. The taking of notes should be encouraged. A loose-leafed note-book with a system of filing similar to a card catalogue is very useful for the organization of material. One sheet should contain notes on only one topic, the name of which should be written at the top of the sheet. In each instance the source of the note should be recorded. Sheets containing material on the same topic should be put together in the note-book. This system admits of indefinite expansion. By organizing material in this manner the student not only records it in a way convenient for later use, but also receives a valuable experience in logical classification.

Intelligent use of maps is of great importance in the study of history. The teacher should give the students definite problems to solve by the use of maps. These problems should begin with the physical characteristics of Europe and include such topics as the Alpine passes, commercial routes, natural and political boundaries, important changes in the unification of states and territorial changes resulting from wars and other causes. In connection with this work, plans of manors, feudal estates, and ethnical and linguistic units should be considered. Frequent use of the blackboard should be made for plans, outlines, and problems.

The preparation of a semester paper by each student is very desirable. For this work the following plan is suggested:

1. The student should find all the books and articles he can that give information with regard to the subject of the paper. These books and articles should be listed on regular 3x5 library cards, one book or article being noted on each card. In the case of each reference the card should contain the name of the author, and the title, place, and date, as follows:

Robinson, James Harvey

An Introduction to the History of Western Europe  
New York, 1901

or

Murray, Gilbert  
Great Britain's Sea Policy  
Atlantic Monthly, CXVIII (1916) 732-45

If an edition of the book other than the first is referred to, this fact should be noted immediately after the title.

2. The student should then read several selections dealing with the subject of his paper.

3. Upon the basis of this reading and any other knowledge he may have with regard to his subject, the student should make a working outline. This outline should consist of a logical arrangement of the principal phases of the topic about which he is to write. For example, a working outline for the subject *The Causes of the French Revolution* might include five sub-heads; namely, the political, social, economic, intellectual, and religious causes.

4. When this preliminary work has been done, the student is ready to take notes and classify them according to his working outline. This method of procedure will enable him to cover the maximum amount of ground and get together the maximum amount of material with the minimum amount of work. The page reference for each note taken from a book or article should be recorded for later use, if needed, in foot-notes in the essay.

5. When the student has taken all the notes he can with regard to each division of his working outline and has properly classified these notes, he should write the paper *from the notes* and not base it directly upon the books from which he has taken the notes. Every important statement in his essay should be supported by reference to the proper authority. *After* each such statement a small figure should be placed slightly above the line, like this<sup>1</sup>. The first reference on each page should be numbered 1 and the other references on the same page should be numbered consecutively. These figures should be repeated at the bottom of the page, each followed by the proper reference. When the book or article referred to is mentioned for the *first* time in the references, the information given on the bibliographical card and the page number should be noted; as, for example, "1. Robinson, James Harvey, *An Introduction to the History of Western Europe*, New York, 1911, 25." Other references to the same book may be abbreviated so as to include only the last name of the author and the page; as, for example, "Robinson, 25."

It may be found advisable from time to time to have a part or all of the class review a book such as Marvin's *The Living Past* or some historical novel, which has more general historical content than textbooks. The purpose of this exercise is to train the students to discern

quickly the main theme and to observe whatever may be new or important in the interpretation.

In the more advanced courses in history, the student should be trained to rely less on the text, and more and more on carefully selected and assigned collateral readings and illustrative source materials. He should acquire some ability to judge the relative value and importance of different accounts, and should develop the power to read rapidly and topically, as well as carefully and consecutively. Careful notes should be taken on the class discussions and lectures, and some real facility in note-taking should be secured. The class reports or theses should deal with more comprehensive subjects than those assigned in the general course, and should therefore, require more extended bibliographies and readings. Some simple but real historical problem requiring criticism and constructive thinking should be involved in each report. The more advanced courses should emphasize historical synthesis, the power to put together facts and opinions from various sources into an account with interpretation by the student himself. At the close of this course the students should be ready to enter more special courses where the text-book is dispensed with entirely and where the work consists of reference reading, discussions, and lectures.

If the second course is in American history, intensive study should be made of the period since 1783 or 1789. While political history will necessarily predominate, emphasis should be laid on the underlying economic and social problems, particularly on the influence of the frontier in determining American development and ideals until a very recent period. The essential unity and continuity of American history must not be lost sight of in the rivalry of the North and South.

For the general course in history a book such as Robinson's *Introduction to the History of Western Europe* should be used as a text. A syllabus such as Trenholme's *A syllabus for the History of Western Europe* and colored physical maps such as those by Johnston would be found advantageous for the use of students. The class should have easy access in the reading room to Robinson's *Readings in European History* (abridged edition), Shepherd's *Historical Atlas*, and Robertson and Bartholemew's *An Historical Atlas of Modern Europe from 1789 to 1914*.

For the course in English history a text-book of advanced character such as Cross' *History of England and Greater Britain* should be used. The class should have easy access to a number of well selected reference books of general and special character. Gardiner's *Atlas of English History*, Low and Pulling's *Dictionary of English History*, the *Dictionary of National Biography*, and the latest edition of the *Encyclopedia Britannica* should be constantly used.

For the course in American history a book such as Fish's *Development of American Nationality* should be used as a text. The class

should have easy access in the reading room to MacDonald's *Select Documents....History United States* (3 Vols.), *Epoch Maps* edited by Hart, and Channing, Hart, and Turner's *Guide to American History*.

*For library equipment, see pages 158-166.*

## ART

1. **Introduction to Art.** This course includes a general survey of the fields of design and representation. The principles and theories are presented in lectures, collateral readings, and discussions. Practice work is done with pencil, pen and ink, and wash and water colors. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

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In view of the fact that college courses in art are not well standardized, a detailed outline of the introductory course in art as conducted in the University of Missouri is given below. While the junior college course need not conform in all particulars to this outline in order to be approved, it should maintain the same standard of work as that represented by the outline. The course in the University of Missouri is given for five periods a week during one semester. Two hours each week are devoted to lectures and discussions, in preparation for which the students are given assignments in reading and drawing. The remaining three periods, each two hours in length, are devoted to laboratory practice. Each section in the outline represents a week's work. For the meanings of technical terms used in the outline, see Dr. Denman W. Ross' *The Theory of Pure Design* and his *On Drawing and Painting*.

The materials used are drawing board and thumb tacks; block of drawing paper; yellow, pale yellow, red, blue, green, and charcoal gray water colors; one small and one large brush for water colors; plate or palette for mixing; cup for water; cloth and sponge; Japanese tracing paper; squared paper; charcoal paper, Michallet being preferable; several sticks of soft, medium, and hard charcoal; kneaded eraser.

The following reference books are used in the course: Reinach's *Apollo*, Prang's *Art Education for High Schools*, Brown's *The Fine Arts*, Ross' *On Drawing and Painting*, Batchelder's *Principles of Design*, Miller's *Essentials of Perspective*, LaFarge's *Considerations on Painting*, and Dow's *Composition*. Each student is required to have a copy of Reinach's *Apollo*, but the other books, which are used only occasionally, are furnished by the institution and placed on a shelf easily accessible to students. The outline of the course is as follows:

General Introduction and a Study of Pictorial Composition with Explanation of Harmony of Tone, Measure, and Shape.—*Discussion*: (1) Brief survey of ground to be covered by the course. List of materials needed. Assignment of first chapter in *Art Education for High Schools* for recitation at the next period and assignment of value scale to be made at home and submitted at the first period of the second week. (The instructor requires assigned home work in drawing to be submitted to him at definite times determined by him.) Assignment of first two chapters in *Apollo* for brief class discussion in second week. (2) Discussion of assigned readings. *Laboratory*: Flat wash; value scale; value contrasts; color wheel. (A good description of the flat wash is given in *Principles of Design*, Chap. III. The value scale and value contrasts and also color are fully explained in *On Drawing and Painting* in the chapter on "Materials and First Exercises," pp. 35-43. These ideas are given in more elementary form by Batchelder and by Prang. *Assignments*: For drawing, value scale painted in charcoal gray. For reading, *Art Education for High Schools*, Chap. I, "Pictorial Composition"; *Apollo*, Chaps. I and II.

Drawing in Terms of Design.—*Discussion*: (1) Demonstration drawing illustrating harmony of tone, measure, and shape, with nature spray or still life as subject. Review of tone. Explanation of dominant and analogous harmonies and of complementary contrasts. (The instructor draws before the class for fifteen or twenty minutes from a nature spray or still life group, using soft charcoal for the purpose of helping the students to visualize simple masses and to render a number of objects by using related terms. In this case the instructor points out and masses in the harmonies of value before him, calling attention to harmony of shape and measure as well.) (2) Lantern slides showing the influence of the principle of harmony in architectural styles and including six to eight examples each of Egyptian, Greek, Roman, medieval, and modern. (The instructor here shows how useful the principle of harmony has been to great builders of the past in attaining beauty. Good photographs are used in place of lantern slides where the latter are not available.) *Laboratory*: Drawing in charcoal a nature spray or still life. Rendering color harmonies from butterflies or other nature material. *Assignments*: The subject of harmony as given in *On Drawing and Painting* (pp. 60-67), *Principles of Design*; Chaps. III and IV of *Apollo*. Drawing landscape in charcoal and making examples of dominant and analogous harmonies and of complementary contrasts. Examples of harmony of T. M. S. (In the examples of the control of the terms by the principles representative elements are eliminated and the students are confined to spots in pure design.)

Painting in Terms of Design.—*Discussion*: (1) Demonstration painting in water colors illustrating rhythm of tone and measure with



nature spray or still life as subject. Explanation of rhythm from design standpoint. (2) By use of lantern, review of architectural styles with emphasis on influence of rhythm, and display of some examples of the painting and sculpture of each period. *Laboratory*: The painting of nature sprays or still life, selected and arranged to illustrate rhythm of tone and measure. *Assignments*: For drawing, landscape in color and examples of rhythm. For reading, rhythm as discussed by Batchelder, Ross (pp. 67-73), and Prang. The discussion of Phidias and the Parthenon in *Apollo* Chaps. V and VI.

The Principles of Design.—*Discussion*: (1) Explanation of balance of tone, measure, shape and position. (A quiz of 15 or 20 minutes on the two principles already studied is given here. Balance of measure, and of tone and measure combined, are very carefully explained.) (2) Lantern review of architectural styles showing influence of balance and emphasizing views of the Parthenon and its sculpture. (Largely the same views as with the other two lectures. Reference to some of the standard works on Greek art.) *Laboratory*: Designs in line and in notan of two and three tones. (*Composition* is consulted for manner of holding brush, subdivision of space, etc.) *Assignments*: For drawing, examples of balance (B-Pos. B-T. B-M. B-TH). For reading, balance as discussed by Ross (pp. 73-79) Batchelder and Prang, and composition as discussed in *On Drawing and Painting*, pp. 186-88, and *Composition*. Continue *Apollo*, Chap. VI.

The Principles of Representation.—*Discussion*: (1) Beginning perspective. Lines in planes, (a) parallel with and (b) perpendicular to the picture plane. (The student is aided in the study of perspective by being led to think of the plane in which a given line lies and of the relation of this plane to the picture plane. By using photographs of nature, paintings, etc., and by constantly referring to the walls, ceiling, floor and furnishings of the lecture room itself, the instructor aids the student to form the habit of thinking in terms of planes rather than in terms of isolated lines.) (2) Explanation of tone with illustration of color complements, various combinations, etc., by use of lantern and textiles. (Slides of the color wheel are used in the lantern, and also pieces of colored glass in complementary color experiments are used. A recitation in color where the student actually produces in color the relation spoken of, may be given.) *Laboratory*: Designs in color. (The idea here is to enhance the interest of the design made in the previous week by painting it. To decide the best possible treatment, a number of experiments are undertaken, such as a color scheme based on several different values of one color, a scheme of analogous colors, and a scheme of complementary colors, etc. The color treatment may increase the harmony, the rhythm or the balance, or any two or even all three of these, and thus greatly benefit the design. If

time permits, work is begun with spots interesting in their tonal relations, and good measure and shape relations for them are found.) *Assignments*: For drawing, view of hallway or long room, with main lines perpendicular to P. P. For reading, *Essentials of Perspective*, Chap. I.

*Composition.—Discussion*: (1) Composition adapted to purpose; principality and subordination. (2) Written test on elements of design and of perspective. *Laboratory*: Posters with a view to purpose, elements of lettering, spacing, completion. (If necessary, the seventh week is devoted to this work, or portfolios may be substituted for posters in this and the following week.) *Assignments*: For drawing, interior showing window in angular perspective with effects of light. For reading, the subject of perspective in *Art Education for High Schools* and the subject of Romanesque and Gothic architecture in *Apollo*, Chap. XII.

*Perspective.—Discussion*: (1) Perspective with reference to lines in planes neither parallel nor perpendicular to P. P. and with reference to vertical planes. (2) Lantern illustrations of perspective including examples of Romanesque and Gothic architecture. (It is very easy to combine two interests here and, while looking at examples of Romanesque and Gothic Architecture, after they have been examined as works of art, to discover the directions taken by lines lying in vertical planes that are neither parallel nor perpendicular to the P. P.) *Laboratory*: Portfolios. (Posters may be continued as an alternative or portfolios may be substituted for posters as noted above.) *Assignments*: For drawing, stairway. For reading, *Essentials of Perspective*, Chap. II.

*Angular Perspective.—Discussion*: (1) Perspective with reference to lines in planes neither perpendicular nor parallel to P. P. and to planes other than vertical, with emphasis on horizontal oblique (up and down hill). (2) Review and quiz. *Laboratory*: Application of perspective principles, including the drawing of large pieces of furniture, parts of the art rooms, etc. *Assignments*: For drawing, light and shade composition depicting a vista of adjoining rooms. For reading, general review of all previous assignments in design and perspective, composition, etc.

(Between the eighth and ninth weeks a mid-semester test is given.)

*Drawing by Elimination of Light.—Discussion*: (1) Demonstration of drawing in charcoal by the "elimination of light" method as a basis of value study. (2) Lantern talk on composition of masses of light and shadow. *Laboratory*: Value studies in charcoal from still life. (This is carried out in accordance with "elimination of light" method.) *Assignments*: For drawing, painting the scale of yellow.

For reading, the subject of personality in LaFarge's *Consideration on Painting*, Chap. II.

Personality in Art.—*Discussion*: (1) Personality and imitation, with special reference to *Considerations on Painting*, Chap. II. (2) Lantern views of the human figure in art. *Laboratory*: Value studies of more varied groups of still life. *Assignments*: For reading, figure drawing in *Art Education for High Schools*; the Renaissance and modern architecture in *Apollo*, Chap. XIV.

The Interrelation of the Arts.—*Discussion*: (1) Demonstration of figure sketching. (2) Lantern views of Venice, Florence, or Paris, illustrating the interrelation of the arts. *Laboratory*: Figure sketching in pencil or charcoal. *Assignments*: For drawing, sketches for students' own composition on subject of Christmas, nativity or modern. For reading, Brown's *The Fine Arts*, Pt. II, Chap. I, dealing with elements of effects in arts of form.

The Subject in Art.—*Discussion*: (1) Lantern pictures of the Nativity as examples of the subject affecting the expression. (2) Chapter on elements of effects in the arts of form in *The Fine Arts*. *Laboratory*: Still life (values as preparatory to water color or chosen medium) composition on the subject of Christmas. *Assignments*: For drawing, scale of red. For reading, significance and beauty in *The Fine Arts*, Pt. II, Chaps. II and III.

Significance and Beauty.—*Discussion*: (1) Recitation on significance and beauty in work of art. (2) Demonstration of water color painting in still life or landscape. *Laboratory*: During this and the following three weeks students are allowed to elect the medium and general character of their laboratory work in order to gain more experience along some one line. Premedic, or other scientific students, elect pen and ink work from suitable specimens; those interested mainly in the art side choose water color or charcoal. *Assignments*: For drawing, drawing at home in elected medium. For reading, the Renaissance at Siena and Florence in *Apollo*, Chap. XV.

Pictorial Ideas.—*Discussion*: (1) Lantern views showing the development of landscape painting. (2) Pictorial ideas and ideals as assigned in preceding week. *Laboratory*: Elective. *Assignments*: For drawing, scale of blue; home drawing in elected medium. For reading, Venetian painting in *Apollo*, Chap. XVI.

The Scope of Representation.—*Discussion*: (1) Lantern views of scope of representation, illustrated largely from works referred to in *Apollo*, Chaps. XV, XVI. (This is intended to summarize the power of representation as a part of art, the scope of ideas possible of plastic and graphic treatment, and the various materials as means of such artistic expression.) (2) The character of the Renaissance as given in *Apollo*,

Chaps. XV to XVIII. *Laboratory*: Elective. *Assignments*: For drawing, elective. For reading, *Apollo*, Chaps. XVII, XVIII.

The Scope of Design.—*Discussion*: (1) Lantern views illustrative of the Renaissance. (2) Lantern views showing general field of design. (This is intended to summarize the whole field of design in the same way the first lecture of the preceding week did for representation which is a part of the field. The trend of the whole semester toward an appreciation of the social value of art is here strengthened.) *Laboratory*: Elective. *Assignments*: For reading, review.

(A final examination is given.)

2. **Construction.** This course consists of a study of structure in the work of art. The past and present usages in the artistic construction of the human figure are considered. The work is conducted by means of lectures, discussions, readings, and drawing and modeling from casts, draped models, and memory. The introductory course in art described above is a prerequisite for this course. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

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As in the case of Course 1, an outline of the course in construction given in the University of Missouri is presented here in order to indicate more definitely what the character of the work should be. This course in the University of Missouri is given five periods a week for one semester. One hour each week is devoted to lectures and discussions. The remaining four periods, each two hours in length, are devoted to laboratory practice.

Hildebrand's *Problem of Form*, translated by Meyer and Ogden, is used as a text. The materials used are charcoal, Michallet charcoal paper, pencil sketch pad, French charcoal, soft drawing pencil, kneaded eraser, bottle of fixative and blower, thumb tacks, drawing board, and apron for use in clay modeling.

This course can be conducted without modeling, but a valuable aid to a better knowledge of form is lost if this is done. The institution can furnish the clay with slight expense, since the same clay can be used repeatedly. If the problems indicated in the outline are found to be too numerous, the less important ones are omitted. When two like problems are set, as in the case of studies of opposed types of head, one is a rapid free development and the other a closely controlled study. A sketch club is maintained in order to give students opportunity for a free form of work with personal choice of medium, etc.

The outline of the course is as follows:

Artistic Structure.—*Discussion*: Explanation of artistic structure, artistic vision, artistic movement. Ideas of two dimensional and three dimensional form. Text-book, Chap. I. *Laboratory*: Drawing of low relief and high relief.

**Artistic Vision.**—*Discussion*: Explanation of properties of form and appearance. Actual and perceptual form. Text-book, Chap. II. *Laboratory*: Drawing of block hand. Drawing of block foot.

**Actual and Perceptual Form.**—*Discussion*: Experiments with the many possible views of one form. *Laboratory*: Drawing from memory of block hand and foot. Relief modeling in clay.

**Form in Space.**—*Discussion*: Ideas of form in space. Space expression. Text-book, Chap. III. *Laboratory*: Modeling of block hand or foot. Drawing of true hand, both from model and from memory.

**Depth.**—*Discussion*: Space considered as penetration into distance. Arrangement of form in suitable planes to suggest depth. Text-book, Chap. IV. *Laboratory*: Drawing of true foot, both from model and from memory. Drawing of two views of skull, with study of actual form as well as of the perceptual form.

**Distance at the Periphery.**—*Discussion*: Relation of small and large forms. Relation of near and far forms through arrangement of planes. Ideas of distance at edge or center of picture. *Laboratory*: Memory drawing of skull. Drawing of skeleton, featuring articulations.

**Artistic Structure in Painting and Sculpture.**—*Discussion*: Examination of artistic structure in the painting of different periods and in the sculpture of different periods. *Laboratory*: Drawing of block head from model; drawing of block head from memory. Drawing of flayed head, with actual form of muscular areas.

**Form as a Relief.**—*Discussion*: Idea of form seen as a relief. Relief conception in painting and sculpture. Text-book, Chap. V. *Laboratory*: Drawing of true head, from model, and drawing of true head from memory. Drawing of true head of opposite type.

**Low Relief.**—*Discussion*: Examination of various low reliefs to determine necessary number of high points; necessity of relation of front and back plane; layer of uniform depth. *Laboratory*: Modeling in low relief from head in the round.

**Relief Conception in the Round.**—*Discussion*: Consideration of relief conception in sculpture in the round both in the open and in the indoors. *Laboratory*: Drawing of an original composition treated as low relief. Developing of this composition and modeling in low relief in clay.

**Form as Expression of Life.**—*Discussion*: Ideas of form as expressing life, movement, etc. Text-book, Chap. VI. *Laboratory*: Drawing of arm. Drawing of leg.

**Spatial Values.**—*Discussion*: Ideas of form as expressing life continued. The spatial value preceding the functional value. Composition embodying these qualities. *Laboratory*: Drawing of torso.

**Functional and Spatial Values.**—*Discussion*: Composition as forceful controlled expression of form. Functional and spatial values. *Laboratory*: Memory drawing of torso. Review of skull and flayed head.

**The Interpretation of Life.**—*Discussion*: Form as interpretation of life reviewed. *Laboratory*: Drawing of living head. In the early part of this last three weeks the head and its integral form are considered as embodied in two planes.

**Sculpture in Stone.**—*Discussion*: Sculpture in stone. Text-book, Chap. VII. *Laboratory*: Modeling living head.

**Review.**—*Discussion*: Review. *Laboratory*: Drawing of living head. The same pose is used for a week or more in order that all the principles governing form in this last drawing may be embodied.

(Examination.)

**3. History of French Painting.** This course consists of a critical study of representative pictures by means of lantern slides, photographs, and other reproductions. The course includes lectures, collateral readings, and discussions. While it is desirable that the students, so far as the course is concerned, know much of the history, literature, civilization, and life of France from mediaeval times to the beginning of the twentieth century, this knowledge should be made secondary to that of French painting during this period. A study of the original paintings and of the best reproductions of these paintings is necessary for satisfactory results. The work of the students should consist very largely of the study, analysis, and comparison of pictures. Such study and comparison is the best possible laboratory work. When Claude's name is mentioned, there should be suggested to the student not a series of names and dates in the life of the artist, but the pictures painted by Claude, their quality, peculiarities, and style. A comparison of Claude with Millet should mean a comparison of the paintings of both artists, or of reproductions of these paintings. Two hours a week for one semester. (2)

**4. History of English Painting.** This course corresponds to course 3, except that English instead of French painting is studied. For explanation of the method that should be used, see description of course 3. Two hours a week for one semester. (2)

*For laboratory equipment, see pages 88-89.*

*For library equipment, see pages 166-168.*

## MUSIC

**1. Appreciation.** This course is planned primarily for students who have no technical knowledge of music. The essential elements in

music are dwelt upon, the styles of masters compared, and monumental works analyzed with reference to their marked points of beauty and their influence upon the progress of the art. Incidentally the historical development of music is treated. Groups of masterpieces are played and analyzed with reference to their beauties and significance. The selections are repeated from time to time so that a familiarity thus obtained may serve the student as a basis for future musical judgment. Technical terms are avoided as much as possible, particular stress being laid on the general elements underlying all the arts. Furthermore, music is here treated not as a thing apart, but chiefly as a manifestation of the universal art principle which differentiates only as it is revealed in word, pigment, marble, or tone. In courses in history of music given in institutions having curricula in music, the work may be somewhat more technical in character, provided that its essentially cultural purpose, which admits of its being considered an equivalent of the course in appreciation, is emphasized. Two hours a week for two semesters. (4)

2. **Harmony.** This course should begin with a thoro study of intervals in order to give the students a knowledge of the melodic and harmonic relationships of tones. The students should then acquire a working knowledge of triads and chords of the seventh and their inversions, preparation and resolution of dissonances in general, modulation, suspension, passing and changing notes, and organ-point. Special attention should be given to those fundamental principles upon which the science of harmony rests. The work in this course should be strictly scientific. It should be based upon the fundamental laws of chord relationship to which the practices of the great composers conform.

Students should work out in written form text-book problems, leaving an extra staff for corrections. These problems should be worked out again with the class by the instructor, and all possible ways in which the problems might be solved should be shown. When the best way is finally selected, it should be written in the vacant staff above the student's offering for comparison with what he has done. Unusual cases should be thoroly discussed and the mooted chords played again and again in their contrasting values, a final decision resting on a criterion of good taste. Figured bases are used thruout the course.

Three hours a week for two semesters. (6)

3. **Counterpoint.** This course includes the addition of parts to a *cantus firmus*. Both simple and double counterpart are studied. Since counterpoint is the art of writing melodies to a *cantus firmus*, it is a great awakening factor for any latent melodic gift which a student may possess, and may, in exceptional cases, pave the way to free composition. As there can be no substitute for inspiration, all that students may hope to acquire by conscientious study is a *reading knowledge*

which really amounts to a full appreciation of counterpoint in its most artistic manifestations in the works of the great composers. Throughout the course that freedom of usage often termed *composer's counterpoint* should be uppermost in the instructor's mind rather than the so-called *book counterpoint*, which is based on the strict regulations of the early experimenters whose procedures are now for the most part obsolete. In this connection, a thorough study of the practices of Bach, as revealed in his well-tempered *Clavichord*, is essential. Three hours a week for one semester. (3)

Credit is not given by the University for junior college courses in music other than those described above.

*For library equipment, see pages 168-169.*

### HOME ECONOMICS

1. **Selection and Preparation of Food.** This is an elementary food course planned to give the student a knowledge of the principles underlying the selection and preparation of food. It should be preceded or accompanied by a course in inorganic chemistry. The study of food should be introduced by some general lessons on digestion. In the study of various foods, emphasis should be given to the economic value and digestibility of each, and to the effect of preparation upon its digestibility. Five hours a week for one semester, or three hours a week for two semesters. (5) or (6)

The course should include a study of the following topics:

(1) Definition and classification of foods: comparison of foods of plants and animals; foods as a source of energy; food as building material; classification of foods on basis of composition and function. (2) Standards of judging foods: chemical; physical; physiological; economic. (3) Sugars and candy making: kinds of sugar; candy making, including a study of the chemistry of sugar; sirups, including a study of the composition and use of sirups in the home. (4) Fruits: composition; methods of preparation; use in the diet. (5) Mineral matter: kind and amount needed; study of distribution in food. (6) Starch and starch cooking: source and structure of starch; effect of heat upon starch; starch puddings, cream sauce and cream soups, including starch proportions. (7) Vegetables: composition and place in diet; cooking to retain mineral matter and soluble constituents; volatile character of much of the flavor. (8) Cereals and cereal products: composition of grains; changes in manufacture of cereals and cereal products; preparation of cereals; cooking cereal products. (9) Classification and general review of carbohydrates. (10) Eggs:



composition; cooking; comparative digestibility of those cooked in different ways; air incorporated in egg as leavening agent, omelette, soufflé, spongecakes. (11) Milk: composition; scum formation; action of acid on milk, as in cream tomato soup; pasteurization and sterilization. (12) Cheese: kinds and composition; methods of preparation; effect of preparation on digestibility. (13) Ice creams and ices: freezing, including function of ice and salt; use of filler; use of binder; kinds and composition of various ice creams. (14) Salad dressing and salads: classification of salad dressings; preparation of salads and salad dressing, including fat in suspension, and in temporary and permanent emulsion; combinations of salads; place in the diet. (15) Fats: composition; use as food; use in cooking. (16) Meats: composition; principles of preparation, tender cuts, tough cuts, very tough cuts; use of left-over meats; effect of preparation on digestibility. (17) Poultry. (18) Fish. (19) Legumes and nuts: composition and value as source of protein; methods of preparation; comparative digestibility. (20) Classification and general discussion of protein. (21) Batters and doughs: general proportion of flour to liquid; kinds of flours, including changes in proportions with different flours; rising agents, their classification and chemistry; special study of cakes and cookies. (22) Preservation of food. (This topic should be inserted at most seasonable time.)

2. **Selection and Construction of Clothing.** The aim of this course is to prepare the student to deal with her own clothing problems. A high school course in sewing is a prerequisite to this course. The selection of materials and the principles of construction should be worked out through the planning and making of underwear and a simple dress. Only a very small amount of time should be given to practice work.

Two hours a week for two semesters. (4) (No credit is given in the College of Arts and Science for this course.)

The course should include a study of the following topics:

Work Apron.—(1) Purpose: to protect clothing. (2) Qualities to be considered: ease with which it may be worn; neatness; hygiene; laundering quality; ease of construction. (3) Selection of cotton material: methods of examining cotton and judging the finished fabric with regard to durability, adulteration, width, weave, color, and shrinkage; laundering quality of the fabric; cost in relation to quality. (4) Selection of design: ease of construction; care; hygiene; protective quality. (5) Construction of garment: drafting pattern (from kimono night gown); cutting, especially with reference to economical use of material; basting; seam finish; button and button hole; hems; method of putting on bias facing. (6) Criticism of finished product after having used it; comparison as to cost and durability of ready-

made and home-made product; disadvantage of variety in design; choice of best design.

Position while Sewing.—(1) Effect of light on the eyes. (2) Effect of bad posture on health. (3) Type of chair most satisfactory for sewing.

Use of Sewing Machine.—(1) History and development. (2) Manipulation. (3) Care. (4) Study of economic value of different makes of machines.

Making of Hand Towel and Holder.—(1) Selection of material: study of linen with reference to absorption and adulteration; choice of material for toweling. (2) Construction: hemming by hand and machine, use of hemmers, study of difference in time and durability of each; method of sewing on hanger. (3) Holder, including case with pad: selection of material for pad, including study of cloth as conductor of heat, and inflammability; construction, including binding with tape; use of binder; sewing on snaps.

Sleeping Garment Problem.—(1) Ideal sleeping conditions: warmth with reference to equal temperature for whole body; relation of sleeping garment to this. (2) Winter night garment: requirements; selection of design with reference to laundering, comfort, and protection of feet; pajamas *versus* night gowns; selection of material, including study of outing flannel, flannelette, and Canton flannel. (3) Summer night gown: selection of design; selection of material, including study of width, durability, weave and laundering quality of muslin, nainsook, longcloth, crepes, and pajama cloth; study of comparative costs. (4) Problems of construction: drafting of pajamas (adapted from waist and straight drawers); drafting of nightgown with sleeves (adapted from waist and kimono nightgown); making of summer garment of muslin; making of winter garment of flannelette. (5) Special problems: plackets; putting on band; sewing in sleeves; whipping. (6) Criticism of finished garment after wearing: check with ready-made garment as to cost and value of final product.

Underwear Problem.—(1) Use of underwear and needs of body: adequate protection without restriction. (2) Necessary garments: combination suit; underwaist; petticoat; sanitary belt and apron. (3) Combination suit: requirements; study of knit and ready-made garments; selection of design with regard to purpose, hygiene, ease of care, and comfort; selection of material, including study of materials used for combination suits, of how to select materials suitable, and of disadvantages of having large variety of materials of practically the same quality; problems of construction, including drafting of pattern; study of finishing, including lace and its economic value, embroidery and its economic value, braids and sticker finishes, bias tape (collect samples of different widths and quality; mount with number and price

attached), woven tape of linen and cotton (collect and mount samples of each with width and price). (4) Underwaist: function: selection of design; disadvantage of corset; stocking supporters; planning of waist to take place of corset; selection of material; firmness necessary to support clothing; study of galatea, drilling, muslin, cable net; problems of construction; draft; study of fastenings with reference to hooks and eyes (different kinds, value of each, method of sewing on), snaps (kinds, method of sewing on), buttons (kinds, methods of sewing on); use of tape; method of attaching supporters; study of elastic and of supporters on the market. (5) Petticoat: discussion of bloomers constructed to take place of petticoat; requirements of petticoat with reference to summer and winter, opaque, easily laundered, easily constructed; suspended from underwaist; discussion of princess slip; advantages and disadvantages; selection of design with reference to four gore, double panel front and back, five gore, double panel front, three gore, and disadvantages of ruffles; selection of material with reference to opaqueness, study of pique, poplin, muslin, galatea, sateen, study of silk petticoats, jersey, crepe de chine, taffeta, dark-colored petticoats of sateen, percaline, etc., and use of bloomers made of material of skirt or dark colored material to match; special problems, including buttonholes, bound for band of skirt, and stitched scallops for finish at bottom. (6) Making of sanitary belt and apron. (7) Criticism of undergarments after finishing and trying out; study of types of ready-made underwear on the market; wool as used for underclothing; selection of a few designs that suit needs of all.

Care of Clothing.—(1) Laundering. (2) Mending: darning; patching. (3) Value of proper care of clothing.

Dress Problem.—(1) Functions of outside garment. (2) Fashion and economic waste. (3) Simplification of dress to give hygienic, economic, and artistic dress for women. (4) Selection of material for wash school dress: cotton, including study of white goods, and colored material and amount of its fading; linen, including study of materials on market and estimate of their value, and comparison of cotton and linen from points of view of practical use and cost. (5) Selection of design, with reference to hygiene, economy, modesty, art, simplicity of construction. (6) Use of commercial pattern: altering of pattern to suit measurements; value of commercial patterns. (7) Criticism of finished garment.

Clothing Accounts.—Keeping of clothing accounts during whole year, itemized so as to be of use in working out clothing budget; working over accounts into budget for following year.

The student should make a large collection of samples of the materials which she studies and catalogues. Liberal use should be made of shops both in the study of ready-made clothing and of materials.

3. **Household Problems.** This course should give the student a general insight into the field of home economics through a study of the modern home. Two hours a week for one semester. (2)

The course should include a study of the following topics:

(1) Function of the home. (2) Woman and her relation to the home from the points of view of the following: Gilman's *The Home*, chapters XV, XVI, and VII; Key's *The Renaissance of Motherhood*, chapter III; Tarbel's *The Business of Being a Woman*, chapters III, IV, and IX; Martin's *The Unrest of Women*, chapters I, V, and VII; Katherine S. Anthony's *Feminism in Scandinavia and Germany*, chapter I; Martin's *Women in Industry, or the New Humanism* (five articles in the *Survey*, March and April, 1916); answers to these articles by several feminists in *Survey*, April 15, 1916. (3) The home as the center of consumption: responsibility of women as consumers. (4) Devices used by producers to control consumers: trade marks; advertising; fashion; special inducements such as trading stamps, premiums, and bargain sales. (5) Control of consumer over producers: by voluntary association through cooperative buying, consumers' league, housewives' league, trade union label; by legislative control in the interest of the consumer and in the interest of the worker; by public provision of market facilities; by utilization of parcel post. (6) Standards of living; meaning and value of a standard of living; relation of standard of living to the division of the income; reasons for increased cost of living. (7) Analysis of the standards along the following lines, including study of present standards and formulation of rational standards: food; shelter; clothing and its relation to fashion. (8) Household management: application of efficiency methods to the home; planning of equipment, including labor saving devices; scheduling and despatching. (9) Domestic service: present situation; suggested solutions. (10) Children in the home: cost; training; rights. (11) Relation of the home to the community.

4. **Food Problems of the Household.** The aim of this course is to prepare the student to deal with the food problem as it presents itself in the average home. The course includes the study of the principle of the balanced diet, the nutritive value and cost of the various food materials, the purchase and care of food in the home, and the equipment needed for preparing and serving food. Throughout the course meals to meet definite conditions are planned, prepared, and served. The courses entitled *Selection and Preparation of Foods* and *Household Problems* are prerequisites for this course. Two hours for one semester. (2)

The course should include the following topics:

**Food Value.**—(1) Food for energy: energy requirement according to age, weight, and activity; fuel value of the various food materials,

with weight, measure, and cost of 100 calorie portions. The laboratory work should include calculation by students of their own energy requirements; planning, preparing, and serving several breakfasts at different costs per hundred calories, each breakfast meeting one-fourth of the daily energy requirement of the group preparing it. (2) Protein: protein standards according to age, weight, kind of protein, and proportion of energy from fat and carbohydrates; protein value of the various food materials with weight of protein in 100 calorie portions. The laboratory work should include calculation by students of their own protein requirement; planning, preparing, and serving several luncheons, using the same costs per 100 calories as in the case of breakfasts, each luncheon meeting one third of the daily energy and protein requirement of the group. (3) Mineral matter: function, requirement and occurrence in foods of iron, calcium and phosphorus; balance of acids and bases. (4) Vitamines: summary of means of securing in diet. The laboratory work should include planning, preparing, and serving several dinners, using again the same costs per 100 calories, each dinner meeting five-twelfths of the daily energy and protein requirement of the group. The mineral matter and vitamines in the menu should receive special emphasis.

Adaptation of Food to the Individual.—Digestibility; palatability; bulk; guidance of appetite; quality; arrangement of meals. The laboratory work should include planning, preparing, and serving of breakfast, lunch, and dinner for one day for a family of two adults, with definite energy and protein requirement and at a definite cost per 100 calories.

Adaptation of Food to the Income.—(1) Food budgets: per cent of different incomes spent for food; cost of food per man per day on different incomes. (2) Laboratory work should include planning of daily menus for a family of two adults at a minimum, a moderate, and a liberal cost per man per day. (3) Factors influencing cost of food: cost of production and of transportation; keeping qualities; demand; quality; flavor; forms; cost of preparation; amount of waste. The laboratory work should include collection from local stores, catalogs, etc.; examples of the influence of these factors on the cost of food.

Feeding of Children.—Change from milk diet; differences from adult's diet; diet at different ages. The laboratory work should include planning, preparing and serving of one day's meals for a child at several different ages.

Methods of Planning Meals.—Use of food records; system in planning. In the laboratory work, each student should start planning menus for a family for one week in spring, summer, fall, and winter, showing definitely the number, age, and occupation of the members of

the family, the locality in which they live, and the size of their incomes.

**Purchase of Food.**—Cost of distribution, wholesale and retail; improvements in methods of marketing and in markets; system in purchasing. In the laboratory work each student should make out a wholesale order for several months for the family for which menus are being planned, with the brand, amount, and cost of each item, and a retail order for one of the weeks planned for. (Wholesale grocery catalogs may be used.)

**Care of Food in the Home.**—Receiving food, storing it, and preserving it in ice box.

**Food Laws**—Adulteration, sanitation of factories and shops; weights and measures, conditions of labor. In the laboratory work, the student should visit and score local markets.

*Home-Made versus Commercially-Made Products.*

*Home Kitchen versus Cooperative Kitchen.*

Recitations and laboratory work should be very closely connected by the planning, preparing, and serving of meals throughout the course. Cost should be emphasized throughout, and meals which fulfill the same requirements should be prepared at different costs. The day should be considered as a whole, and the three meals should meet each set of conditions prepared either at successive or at the same periods.

The nutritive value and cost of recipes and meals should be calculated from the table of 100 calorie portions, and put in permanent and convenient form. For this permanent form a card catalogue is better than a notebook. It is convenient to use 4x6 inch cards, punched at the top so they can be hung up, and printed with headings for material, measure, weight in ounces and grams, protein in grams, calories and cost. (These may be purchased from the University Cooperative Store, Columbia, Missouri.) Plain 4x6 cards may be used for daily menus and order lists, and all may be filed in a pasteboard or wooden card box.

*For laboratory equipment, see pages 89-93.*

*For library equipment, see pages 169-171.*

## EDUCATION

1. **Educational Psychology.** The purpose of this course is to lay the foundation for an understanding of the science of education. Better results will be obtained if this work is preceded by a course in general psychology. This course should include a thoro review of the fundamental principles of general psychology, with special attention given to heredity and the relation of mind to body. The instinctive

tendencies should be carefully studied with a view to finding out how they may be controlled and directed through education. The laws of habit formation, of learning, and of moral training should be mastered, and, in such matters as memory, drill, and fatigue, special emphasis should be placed upon the practical application of the methods, principles, and results of experimental psychology to the problems of the school. This course should include, also, a thoro treatment of interest, attention, and thinking. If time permits, mental and physical tests, and the methods and scales for measuring the school abilities should be studied, and, if possible, applied. It is advisable to use some standard text-book, such as Pyle's *The Outlines of Educational Psychology* and Thorndike's *Educational Psychology*. Three or four hours a week for one semester. (3) or (4)

2. **History of Education.** This course should give a better understanding and appreciation of present educational practices and tendencies by tracing historically the more important movements that have made the present educational situation. History gives an appreciative understanding of social practices thru connecting them intimately with the purposes in the service of which they were established. It thus prevents formalism and makes social customs plastic for improvement. When treated historically educational practices should be regarded not as mere facts, but as the solutions of problems which arose in carrying out social purposes and which determined from stage to stage the growth of the school. In studying an educational practice historically, the students should be led to understand the social situation in which it began, to appreciate the purpose which it served, and to recognize the difficulty which it was intended to overcome in realizing this purpose. It is desirable to have one library copy of each important reference book for each four students in the class. Such books as Graves' *A History of Education* (3 Vols.) are suitable for a text-book. Two hours a week for two semesters. (4)

3. **Methods of Teaching.** This course should include such topics as the course of study, the value of different units of subject-matter, interest and motive, methods of presenting the subject matter, drill, assignments, and applications. The chief stress should be laid upon problems of instruction in the elementary grades. Three hours a week for one semester. (3) (No credit for this work is given in the College of Arts and Science.)

4. **School Management.** This is a course in effective methods of class-room management. The following topics should be studied: the teacher's preparation for her work; the apportionment of the teacher's time; weekly and daily schedules; the routine of class-room management; the technique of class instruction; hygienic conditions of the class room; how to secure and hold attention; examination, graduation,

and promotion of pupils; school records and reports; teaching pupils to study economically; supervised study and the study-recitation; relation of teacher to principal, supervisor, and superintendent; important sections of the state school laws. Three hours a week for one semester. (3) (No credit for this work is given in the College of Arts and Science.)

*For library equipment, see pages 171-177.*

## RELIGIOUS EDUCATION

1. **Fundamental Moral and Religious Values.** This course should consist of a study of the moral and religious qualities in human personality which are essential to the highest welfare of the individual and of society. It should be open only to students who are in the first year of college work. One hour a week for two semesters. (2)

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In describing this course the University desires not to impose upon any denominational college restrictions that would interfere in any way with the religious faith represented by the college. For this reason the outline of a course approved by the University in an affiliated college is given below merely to indicate the general character of the work that should be required in the course and not to set specific requirements for text-books and precepts. Where the work in a junior college course varies from that indicated by the outline, it cannot be approved if it is inferior in character to the work indicated by the outline.

Kent's *Life and Teachings of Jesus* is the first text-book used in the course referred to above, which has been approved in an affiliated college. The work covered in this book begins with the first chapter and completes the sections in the main body of the book, including the section on "The Rewards of the Christian Life," page 202. The five chapters at the beginning are passed over rapidly, except the fifth chapter, but close and intensive work is done beginning with section CXXI on page 43. The character of Jesus is studied from the psychological and moral rather than from the theological point of view. The one question kept uppermost in the minds of both teacher and student is: What was the attitude and disposition of Jesus toward his fellows and toward God, as revealed in his actions and words? Each section of the book is found to furnish one or more points in the fundamentals of character, such as courage, sincerity, humility, forgiveness, etc. The purpose of the work here is not to make a mere catalogue of virtues and vices, but rather to learn from a study of the life and teachings of Jesus what he considered qualities of character essential to the highest welfare of the individual and of society.



Sections CXXII and CXXIV of the text-book are studied together, as both tell about John the Baptist. John the Baptist's appearance, manner of life, and message are emphasized together with the effect which his preaching had upon the people. In considering his message attention is given to how he shared the popular expectations concerning the kingdom, and concerning the nature of the Messiah and his mission. In the gospel references to the preaching of John, attention is called to the numerous references to fire, which stands for punishment. Jesus' answer to John (p. 69) should be considered where John, because he is in doubt about Jesus, sends from his prison two of his disciples to ask Jesus whether he is the Coming One. The answer should be compared with Luke 4:16 f. According to Jesus, his work is not that of a judge to condemn, but that of a savior to deliver and to redeem. This contrast should be carried into the next part of the text, "To what shall I liken this generation, etc?" This throws further light upon Jesus' ideal of life. Attention is then turned to the text giving Jesus' approval of John, in which he commends those moral qualities in John that he thinks worthy of imitation. These qualities which are still needed by men are courage, reliance, independence, and hardness. Jesus reveals his own nature in his judgment of John the Baptist.

The next book studied as a text-book is Coffin's *Some Christian Convictions*. About twenty pages are taken for each lesson. The teacher discusses the advance lesson with the class and assists the students to find the essential points. This book gathers up and crystallizes the points developed in the study of Kent's *Life and Teachings of Jesus*, and helps the student see how his religious beliefs may be harmonized with his total intellectual faith. A sample study of one of the chapters in this book is given below merely as suggestive of the way in which the points mentioned by the author are taught.

The first chapter of *Some Christian Convictions* deals with religion. As an introduction to this chapter an appropriate theme is the well known saying of Augustine, "Thou, O God, hast made us for thyself, and our hearts are restless till they find rest in thee." The chapter is a study of religious experience, and the content of that experience is God (Cf. p. 54). The author's reasons for saying that religion is normal experience are carefully considered, and the fact emphasized that as a normal experience it is an affair of the whole personality (p. 25). This is a brief but satisfactory discussion of religion from the psychological standpoint. A consideration of the theme, how does each man get his religious experience for himself, begins on page 32. The answer to this question is that each man must discover God for himself; that the nature of this discovery depends upon the temperament of the individual; and that the depth of the experience of God is limited by

each man's capacity, which may be cultivated, so as to increase assurance of the certainty of his knowledge.

The validity of our religious experience, a new theme, is introduced on page 42. The satisfaction given by religion to man's complex personality in all ages and the practical value of religious experience are emphasized as tests of this validity. On the basis of what is given at the bottom of page 42 a summary of the whole chapter is made.

To save the course from becoming too academic and to make it more practical, the class next reads King's *Moral and Religious Challenge of Our Times*. - - - -

2. **The Bible as Literature.** This course should consist of a purely literary study of the Bible with a view to a knowledge of the nature of the content, and to an appreciation of the beauty, variety, and power of the Holy Scriptures as works of literary art. Two hours a week for one semester, or one hour a week for two semesters. (2)

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As in the case of the course in fundamental moral and religious values, the outline of an approved course in an affiliated college is given in order to indicate the general character of the work that should be required in the study of the Bible as literature.

In the approved course referred to, Moulton's *Modern Reader's Bible* is used as a text. In view of the fact that if the student uses a textbook other than the Bible, he reads the text to the neglect of the Bible itself, the student's reading in this course is confined mainly to that portion of the Bible under consideration from day to day, while other readings are made secondary to this reading. Moulton's *A Short Introduction to the Bible as Literature* and his *The Literary Study of the Bible* as well as reference books listed on pages 177-178 of this bulletin are used in connection with discussions of readings in the Bible.

The course includes either the historic, epic, and wisdom literature, or the lyric, prophetic, and apocalyptic literature of the Bible.

When the historic, epic, and wisdom literature is studied, the work is as follows:

The first meeting of the class is devoted to such matters as learning the place of the Bible in relation to Hebrew literature and to Semitic literature, noting the differences in the order of the books in the Hebrew, Septuagint, Latin, and English versions of the Bible together with the reasons for these differences, and learning a brief account of the most important translations. The introductory work is concluded in the second meeting of the class by a review of the first chapter of Moulton's *A Short Introduction to the Bible as Literature*.

About twelve meetings of the class are devoted to the study of the historic literature. The students gain in this study a clear idea

of the more prominent characteristics of the history of the Hebrews and of the development of the New Testament church as these appeared to the writers themselves. Owing to lack of time and to the student's meagre preparation for such work, there is no detailed study of questions of criticism. Attention is given to the literary forms and to other literary characteristics of the various sections of the historic literature studied. For example, in the first recitation in historic literature the class covers *Genesis*, which contains the materials for primitive history as outlined by Professor Moulton. The attention of the class is called to the facts that the materials are chiefly in story form and that there are some history, some genealogical tables, and a few poetic fragments. The students learn to appreciate the difference between story narrative and historic narrative by comparing such passages as *Genesis* 11:1f with 14:1f. Concerning the poetic fragments, they note the parallelism which is the ground work of all Hebrew poetry, the antique meter so well suited to extemporaneous composition, and stanza lengths determined by the same considerations that determine paragraph lengths in prose. With regard to the content of the book, they learn the first portion as giving the beginnings of the world, man, crime, work, musical instruments, implements of manufacture, languages, etc.; the second portion as giving the account of God's sifting of peoples in selecting a chosen family through which he would raise up a nation as his own peculiar people; and the third portion as giving the story of Joseph, which is intended to show how the Israelites were transplanted from Palestine to Egypt.

Ten to twelve meetings of the class are devoted to epic literature. The first recitation in this part of the work is given to a consideration of the criteria for judging a story so as to evaluate it properly. The student reads the story materials of the historic sections anew and all of the epic books of the Bible, although there is not time to treat all of this in detailed class discussion. During the recitation hours the different types of stories are considered and the best ones of each class studied intensively. Recitations are devoted to a study of the stories of Cain and Abel, Joseph, the Ten Plagues, Balaam, Samson, Ruth, Elijah, Elisha, Daniel, Tobit, and Esther. As a result of the study of the epic literature, the student should be acquainted with the epic materials of the Bible, their character, qualities of excellence, etc.

The wisdom literature is covered in about ten recitations. An introductory recitation treats of the rise of wisdom literature, its spirit, development, and forms. One recitation is devoted to each wisdom book, except in the case of the *Book of Job*, to the study of which two or three recitations are devoted. The students acquire an appreciation of the most striking qualities of these books, a knowledge of their contents, and an acquaintance with the development of wisdom literature in general.

When the lyric, prophetic, and wisdom literature of the Bible is studied, the work is as follows:

About ten or twelve recitations are given to a study of the different varieties of lyric literature. The *Book of Psalms*, *Lamentations*, *Song of Songs*, and parts of the *Book of Job* and of the prophetic books are considered. The lyrics which grew out of the dance are traced in their development through the processional ode and anthem to meditation. The lyrics which grew out of the wail or dirge are considered, *Lamentations* being studied as the most elaborate example of this type. In the study of the *Song of Songs* attention is given to how the arrangement and interpretation depend on whether the book is considered as a drama, as a lyric idyl, or as a collection of songs used with the seven days' wedding feast. A concluding recitation is devoted to the general consideration of Hebrew poetry, verse, metre, and the means of securing beauty, variety, etc.

In the study of prophetic literature, to which about fifteen to eighteen meetings of the class are devoted, the introductory work defines prophecy, indicates its general spirit, names the literary forms used by prophetic writers, and characterizes briefly and illustrates each form. The students then study the historic setting of each prophet and the circumstances calling forth his message. Then the students by reading the book become acquainted with the message, point of view, and spirit of the prophet. Special attention is given to the literary forms used and to their qualities and degrees of excellence.

The apocalyptic literature of *Daniel* and the *Book of Revelations* are covered in a briefer time than any other division of the work,—four to five recitations. Aside from the general content of the books, the students give attention to the chief characteristics of this form of literature and to the influences which produced them.

*For library equipment, see pages 177-178.*

### PHYSICAL TRAINING

1. **Physical Training, Practical Course.** This course includes (a) marching, floor tactics, and class evolutions; (b) graded free exercises and drills with light apparatus and developing appliances, graded club swinging, dumb bells, etc., graded balance exercises, and dancing; (c) graded apparatus exercises; and (d) introductory graded exercises in athletics, gymnasium drill, drills in hand tennis, handball, basketball, and volley ball.

The course in physical training should be given the first year. A suitable room with plenty of light and air and free from obstructions should be available. The equipment should include Indian clubs, dumb-

bells, and barbells in suitable number for class drill; some apparatus such as leather buck, leather horse, ladders, rings, and mats for graded work; playing space for games, and reasonable locker, bathing, and dressing facilities. The gymnasium costume should be required.

In the fall and spring the work should include outdoor games such as hockey, tennis, basketball, playground ball, and track athletics. Swimming is excellent if facilities are possible.

The regular physical work should be supplemented by occasional talks on dress and posture, on personal, home, and public hygiene, and on general matters of health. Three hours a week for two semesters.  
(2)

*For laboratory equipment, see page 94.*

*For library equipment, see pages 178-179.*

## II

### SUGGESTIONS FOR THE EQUIPMENT OF LABORATORIES

#### GENERAL INFORMATION

The biological laboratories should be located on the north side of the building. The dimensions of each room used for biological work should be much greater from east to west than from north to south, since it is desirable to have as much north light as possible. The laboratories for work in physical sciences may be located advantageously on the south side of the building. Since sun light is often needed for work in physics, it is well to have one or two windows in the physics laboratory exposed to the sun. All laboratories should be supplied with gas, water, and electricity.

In the construction of a new building which is to contain a laboratory, it is important to remember that the windows should be high, running up to the ceiling; that the rooms should not be so deep from the windows on the north to the opposite wall on the south as to render it difficult for light to get readily across, and that the distance from the top of the window sills to the floor should be the same as the height of the laboratory tables. In horizontal measurement, the windows and intervening spaces of brick or stone should be about equal in width. Therefore, in horizontal measurement the north front of a laboratory should be nearly half glass. Too great care cannot be exercised to secure perfect ventilation. The temperature should be kept uniform.

The class-rooms for recitations and lectures should be near the laboratories, so that apparatus and specimens may readily be transferred to and fro. Each room of this kind should contain a substantial demonstration table equipped with gas, water, and electricity, and provided with suitable drawers and cupboards. The room should contain also a projecting lantern, and should be curtained with opaque enameled cloth so that it can be quickly darkened. In Missouri climate there are enough clear days to warrant the use of sunlight in the class-room in physics. One of the best arrangements is to place the end of the demonstration table toward a south window. Sunlight can then be thrown the length of the table by a mirror (heliostat) placed in the window.

In the planning of laboratories, provision should be made for the storage of apparatus and supplies by setting aside several small rooms conveniently located to serve as preparation and service rooms. Cases

should be provided for demonstration apparatus, models, charts, microscopes, and many other laboratory accessories.

It is not economy to buy too cheap apparatus. Before purchasing one should submit lists to various dealers for bids. Because of the war, the cost of equipment will be found to vary from the prices quoted in this bulletin. The names and addresses of dealers are given in this bulletin in connection with lists of laboratory supplies needed for work in the several sciences.

## PHYSICS

In equipping a laboratory for physics, it is necessary to plan a definite list of experiments and to buy the apparatus necessary for these experiments. Because of this fact, it is not feasible to recommend a definite list of laboratory apparatus. The teacher should first choose the laboratory manual, and then the particular experiments. The apparatus must be chosen to fit these experiments. The following is a list of apparatus suitable for use in the class-room for demonstrations to be given by the teacher. Since the experiments selected for the course may vary with the teacher, the text, and local conditions, the list is intended to be suggestive rather than complete in detail. It does not include, furthermore, such common things as meter sticks, glassware, and weights. This list includes apparatus for both Course 1 and Course 2. If only Course 1 is given, the list should be correspondingly reduced. Many suggestions may be obtained by studying the larger apparatus catalogues, since much of the apparatus illustrated in these catalogues is intended for demonstration work. The equipment should be of such quality and quantity that a sufficient number of experiments of college grade can be performed. Much of the apparatus should be of a more accurate type than that commonly used in high schools.

Air pump to go to 3mm. pressure, bell-jars and accessories.

Guinea-and-feather tube

Rotator and accessories

Model wheel and axle

Seven-in-one apparatus (Spirometer)

Barometer tubing (glass)

Simple barometer

Archimedes principle, cylinder and bucket

Balance suitable for demonstrations, sensitive to 1-5 gram

Models of lift and force pumps

Cartesian diver

Hydraulic press or hydrostatic bellows

Set of universal supports, clamps, etc.

Running water and gas at lecture table

Alternating and direct currents available at table  
Aspirator, or water pump  
Lantern for projection  
Hydrometers, variable immersion type  
Magdeburg hemispheres  
Apparatus for illustrating expansion by heat, as ring and ball  
Simple air thermometer  
Hope's apparatus for maximum density of water  
Specific heat apparatus (paraffin cake and metal balls)  
Three or four barometer tubes with liquids above mercury to show vapor pressures  
Round bottom flasks for boiling water under reduced pressures  
Apparatus for freezing water under air pump  
Pair of reflectors, iron ball, blackened-bulk air thermometer for radiation experiments  
Fire syringe  
Models of gas and steam engines  
Thermo-couple and thermopile  
Wave model, or apparatus for illustrating wave motions  
Apparatus for bell-in-vacuo experiment  
Siren disk and Savart's wheel (to fit rotator)  
Several organ pipes  
Several tuning forks—pitch should correspond to fundamental and overtones of one of the organ pipes  
Two forks of same pitch mounted on boxes for showing resonance and beats  
Sonometer  
Electroscope suitable for projection or class use  
Hard rubber rods, hard glass, pith balls, etc.  
Electrophorus  
Static machine (Toepler-Holtz or Wimshurst)  
Faraday ice pail experiment  
Four Leyden jars and discharger  
Parallel plate condenser with movable plates, sphere and cylinder with rounded ends, on insulated stands  
Two bar magnets, filings, tacks, etc.  
Magnetic needle about 4 inches long mounted as a compass  
Dipping needle  
Lecture table D'Arsonval galvanometer  
Bank of incandescent lamps, or other variable rheostat, that can be put on power circuit  
Arago disc (to fit rotator)  
Lecture table ammeter and voltmeter  
Coils for showing induced currents



Coils and iron core for assembling a simple transformer  
 Induction coil  
 A coil to use as earth inductor  
 Simple dynamo and motor  
 Apparatus to show electrolysis of water  
 Apparatus to show copper plating  
 Geissler tubes  
 Crookes tube to show cathode ray phenomena  
 Set of small portable white screens for table  
 Several projection lenses, 8", 12", 15", 24" focal lengths, mounted in reading glass mounts  
 One diverging lens, 8" focus, mounted  
 Convex and concave mirrors  
 Prism and adjustable slit, for projection of spectra  
 Spectrum tubes of hydrogen and helium  
 Glass water tank for refraction experiments  
 Replica diffraction grating  
 Piece of clear calcite (Iceland spar)  
 Newton's rings apparatus (for projection)  
 Pair of tourmalines (to show polarization)

#### DEALERS IN PHYSICAL APPARATUS

Bausch and Lomb Optical Co., Rochester, N. Y. (projection apparatus); James G. Biddle, 1211 Arch St., Philadelphia (importer); Central Scientific Co., 460 E. Ohio St., Chicago (general supplies); Wm. Gaertner & Co., 5347-9 Lake Ave., Chicago (general apparatus); Leeds and Northrup Co., 4901 Stenton Ave., Philadelphia (resistance boxes and galvanometers); C. H. Stoelting Co., 121 North Green St., Chicago (general supplies); Weston Electrical Instrument Co., Newark, N. J. (ammeters, voltmeters and watt-meters).

### CHEMISTRY

In laboratory equipment, the two main items of expense are the tables and the individual outfits of apparatus for use of the students. Substantial tables supplied with water, gas, and sinks should be provided. Two tables each 16 feet long and with lockers and drawers on opposite sides will accommodate two sections of 16 students. The first cost of the laboratory desks including plumbing will range from \$15 to \$20 a lineal foot. The individual outfits of apparatus, at the relatively high prices that prevail at the present time, will cost approximately \$18 each. The major portion of the outfit of apparatus required for the first courses will also serve for the laboratory work in qualitative analysis and organic chemistry. Some special pieces of appa-

ratus and additions to general laboratory equipment should be provided for these courses. Suction filters, several hand centrifuges, and a set of about six individual reagent bottles will be required for the students in qualitative analysis. Condensers, distilling flasks, thermometers, and water baths must be added for the work in organic chemistry.

The laboratory should be provided also with a good draft hood, reagent and balance shelves, a set of uniform reagent bottles for both solids and solutions, a barometer, and several balances and weights including balances for quantitative experiments. An automatic water still and a blast lamp and bellows are essential to the equipment. A steam bath, hot plate, and a drying oven should be provided. In planning a chemical laboratory a separate ventilating system should be installed.

In addition to tablet arm chairs and a teacher's desk, a demonstration table equipped with water, gas, and electricity is needed for the class-room experiments to be conducted by the instructor. Ample blackboard space is required. A projecting lantern is very serviceable, and for its effective use opaque shades for the windows should be provided.

Ample space and shelving are necessary for housing the stock of reagents and apparatus. A separate storeroom should be provided for this purpose, and this room should be conveniently located for dispensing apparatus to students. Moreover, a stock of lecture-room demonstration apparatus and specimens should be added and suitable cases should be provided for it.

The larger and more important forms of apparatus and accessories required for demonstration purposes are as follows:

Cylinders of compressed oxygen, liquid sulphur dioxide, liquid carbon dioxide, liquid chlorine and liquid ammonia.

Several fair sized Kipp generators

Wall charts of the elements, the periodic system, international metric system

Spectroscope and spectrum tubes of some of the common and rare gases

Induction coil

Barometer tubes

Dewar flasks and tubes

Demonstration balance and weights

Gas holder

Hoffman electrolysis apparatus

Apparatus for the volumetric composition of steam

Ozone tube

Galvanometer

Analytical balance and weights

Standard solutions of an acid and a base

Specimens of the common minerals

Samples of the raw material and some manufactured products of several chemical industries

25 lbs. mercury

10 grams of platinized asbestos

Platinum wire and sheet platinum

(For list of dealers in chemical supplies, see page 179.)

## BOTANY

### GENERAL BOTANY

*Equipment for twelve students working at the same time.*

The list of apparatus given below represents a fairly complete equipment adapted for a general course. Some pieces of apparatus may well be omitted and others added. Various adaptations may be made in the use of glassware, etc. The list includes the materials that have been found very satisfactory in actual experience.

In order to indicate the materials briefly and definitely, references are made by numbers to items listed in the catalogue of the Arthur H. Thomas Co., West Washington Square, Philadelphia, Pennsylvania. Practically the same apparatus can be obtained from other firms the names and addresses of which are given after the lists of equipment for general botany and general bacteriology.

#### INDIVIDUAL EQUIPMENT

1 compound microscope with two objectives .....	\$25.00 to \$30.00
(The objectives giving the best results are the 16 mm. and the 4 mm.)	
1 pair small fine-pointed scissors .....	
1 scalpel .....	
1 pair forceps, medium fine with straight points .....	
Several microscope slides, 3x1 inches .....	
A few cover glasses, 18 mm. No. 2 .....	
Small amount of lens paper .....	

#### GENERAL EQUIPMENT

##### *Apparatus*

6 aluminum shells, Ganong, for transpiration experiments (Bausch & Lomb Optical Co.) .....	1.75
1 balance, counter, in ebony box with marble top and heavily nickel plated pans, Dia. pans 8 in. (A. H. Thomas Co., 21520) .....	16.00
1 balance weights, in polished block, 1 g. to 1 k. (A. H. Thomas Co., 21556) per set .....	5.00

6 battery jars, 4 liter capacity, height 225 mm., diam. 150 mm. (A. H. Thomas Co., 21800), each .....	\$ .65
12 battery jars, 1 liter capacity (A. H. Thomas Co., 21800) each .....	.25
3 bell-glass, high form, with ground flange, height 17 in. diam. 8½ in. (A. H. Thomas Co., 21936), each .....	1.75
12 bladders, animal, dried, assorted sizes (A. H. Thomas Co., 21960), per doz. ....	1.00
20 bottles, wide mouth, American flint glass, for cork stoppers, cap. 500 cc. (A. H. Thomas Co., 22210), per 10 .....	.90
20 bottles, narrow mouth, American flint glass, for cork stop- pers, cap. 500 cc. (A. H. Thomas Co., 22200), per 10 .....	.85
50 bottles, dropping, capacity 50 cc. (A. H. Thomas Co., 22132), each .....	.25
2 boxes, geotropic and phototropic .....	
6 bunsen burners, (A. H. Thomas Co., 22816), each .....	.25
Card board .....	.13
6 clamp (Lincoln) for burettes (A. H. Thomas Co., 24598), each .....	.75
12 clamps, test tubes, Stoddard nickled spring wire, small, 4½ inches long (A. H. Thomas Co., 24630), each .....	.10
1 clamp stand (Ganong) portable (Bausch & Lomb Optical Co.) .....	8.00
1 clinostat (Ganong) demonstration (Bausch & Lomb Optical Co.) .....	22.50
Corks, assorted sizes .....	
1 cork borer of hard brass, No. in set 6. (A. H. Thomas Co., 25122) .....	1.00
3 cylinders, graduated 100 cc. capacity (A. H. Thomas Co., 25770), each .....	.50
2 cylinders, graduated 500 cc. capacity (A. H. Thomas Co., 25770), each .....	1.00
6 dewar flasks or thermos bottles .....	
100 filter paper, B. & L. A1, medium weight, in sheets 450x550 mm. (Bausch & Lomb Optical Co., 14166) per 100 sheets .....	1.75
20 flasks, Erlenmeyer, capacity 120 cc. (A. H. Thomas Co., 28176), each .....	.13
6 flasks, Erlenmeyer, capacity 500 cc. (A. H. Thomas Co., 28180), each .....	.20
12 funnel tubes, straight with thistle top, length 400 mm. (A. H. Thomas Co., 28744), each .....	.12
12 funnels, of clear white glass, with stem ground to point. Diam. 120 mm. angle 60° (A. H. Thomas Co., 28544), each .....	.20

2 light screens, Ganong, part leaf form (Bausch & Lomb Optical Co.), each .....	\$ 1.25
6 glass plates, 12x12 inches .....	
12 glass plates, 5x5 in. ....	
½ lb. glass rod, 1 cm. diam. (A. H. Thomas Co., 29856), per lb. ....	.40
¼ lb. glass rod, diam. 6 mm. (A. H. Thomas Co., 29856), per lb. ....	.40
1 K glass tubing, 6 mm., 8 mm., 29 mm. inside diam. (A. H. Thomas Co., 29864) per lb. ....	.40
1 incubator, Freas electric .....	75.00
India ink .....	
Labels, Dennison's gummed .....	
6 lamps, alcohol, cap. 60 cc. (A. H. Thomas Co., 30800), each .....	.40
12 books lens paper, Japanese (A. H. Thomas Co.) .....	
12 pans, granite iron, diam. 6", depth 2½" .....	
Plns .....	
24 pipettes, dropping, 4" long with straight top and rubber bulb, (A. H. Thomas Co., 43428), per doz. ....	.40
Pipettes, volume or transfer (A. H. Thomas Co., 43504), cap. 1cc., each .....	.10
12 plates, white .....	
6 retorts, with tubulature but without glass stopper, cap. 150 cc. (A. H. Thomas Co., 46020), each .....	.22
1 lb. rubber stoppers, No. 10, 2 holes, diam. top, 50 mm., bottom 42 mm., No. per. lb. 7 (A. H. Thomas Co., 46180), per lb. ....	2.00
1 yd. rubber cloth, 1 yard wide .....	
10 ft. rubber tubing, red or antimony, inside diam, 5 mm. (A. H. Thomas Co., 46216), per foot .....	.10
10 ft. rubber tubing, red or antimony, inside diam. 8 mm. (A. H. Thomas Co., 46216), per foot .....	.16
20 ft. rubber tubing, white, inside diam, 8 mm. (A. H. Thomas Co., 46220), per foot .....	.10
1 demonstration spectroscope, Ganong (Bausch & Lomb Optical Co.) .....	24.50
String .....	
6 supports, apparatus, tripod base, copper plated rod, medium, height of rod 50 cm. (A. H. Thomas Co., 47676) .....	.45
500 test tubes, with lip, thin walled, length 120 mm., diam. 15 mm., (A. H. Thomas Co., 47944), per 100 .....	1.55
20 test tube brushes on tinned wire, bristle with bristle end (A. H. Thomas Co., 22496), each .....	.06
6 test tube supports (A. H. Thomas Co., 48020) with 6 holes, each .....	.30

6 thermometers, chemical, centigrade, graduate to 100° (A. H. Thomas Co., 48212), each .....	\$ 1.10
6 tripods (A. H. Thomas Co., 48616), 3 rings, each .....	.40
10 tubes, fermentation (A. H. Thomas Co., 27600), each .....	.35
24 tumblers .....	
100 vials, homeopathic, short form with neck, flat bottom and cork stopper, capacity 3 drachms, height 63 mm., diam. 17 mm. (A. H. Thomas Co., 48912), per gross .....	2.00
24 watch glasses, Syracuse, with ground bevel (A. H. Thomas Co., 49028), each .....	.06
6 rings, support, diam. 3¾" (A. H. Thomas Co., 46072), each .....	.17
6 clamps, (A. H. Thomas Co., 24534), each .....	.40

*Chemicals*

50 g. iodine, resublimed.	
50 g. potassium iodide, C. P.	
500 g. sodium chloride, C. P.	
500 g. hydrochloric acid, C. P.	
1 k. potassium hydroxide, C. P.	
100 g. eosin (soluble in water)	
500 g. corn starch	
4 litres alcohol (ethyl) 95%	
500 g. glucose	
500 g. cotton	
100 cc. benzine	
10 g. diastase	
50 g. zinc chloride, C. P.	
1 k. sulphuric acid, C. P.	
500 cc. olive oil	
1 g. osmic acid	
10 g. Sudan III	
500 g. nitric acid, C. P.	
500 g. ammonia, C. P.	
500 g. barium hydroxide, C. P.	
3 k. mercury	
100 cc. ether	
500 g. cane sugar	
50 g. potassium nitrate, C. P.	
50 g. dihydrogen potassium phosphate, C. P.	
50 g. magnesium sulphate, C. P.	
50 g. iron chloride, C. P.	
50 g. potassium chloride, C. P.	
50 g. sodium nitrate, C. P.	

- 50 g. dihydrogen sodium phosphate, C. P.
- 50 g. sodium sulphate, C. P.
- 50 g. magnesium chloride, C. P.
- 50 g. ammonium tartrate, C. P.
- 50 g. calcium phosphate, C. P.
- 50 g. mercuric bichloride, C. P.
- 50 g. copper sulphate, C. P.
- 100 g. sodium potassium tartrate, C. P. } For Fehling's solution
- 100 g. sodium hydroxide, C. P. }

*Sets of Prepared Microscopical Slides*

(Each set includes twelve slides. Items starred are most important.)

- \*Fern—transverse section through stem of *Pteris aquilina*
- Fern—transverse section through leaf of *Polypodium*
- \*Fern—transverse section through prothallus for archegonia and antheridia
- Fucus—transverse section through oogonial conceptacles
- Fucus—transverse section through antheridial conceptacles
- \*Leaf—transverse section through leaf of dicotyledon (osage orange)
- \*Lily—transverse section through anther
- \*Lily—transverse section through ovary; development of embryo sac
- Lily—pollen grains
- Lily—germinating pollen grains
- Marchantia—transverse section of thallus
- \*Marchantia—longitudinal section through antheridial disc
- \*Marchantia—longitudinal section through archegonial disc for archegonia
- \*Marchantia—longitudinal section through archegonial disc for sporophytes
- Mildew—section of perithecia on willow or lilac
- Mold—germinating spores
- Moss—longitudinal section through antheridial branch for antheridia
- Moss—longitudinal section through archegonial branch for archegonia
- \*Mushroom—section through pileus for basidia
- \*Pine—transverse section through staminate cone
- \*Roots—longitudinal section of root tips (hyacinth or onion)
- Roots—transverse section of root (sunflower)
- \*Rust—transverse section of barberry leaf showing aecidium cups and pycnidia
- Stems—transverse section of corn
- \*Stems—transverse section of castor bean
- \*Stems—longitudinal section of castor bean
- \*Stems—transverse section of 1 yr. and 3 yr. old basswood stem

*Plant Material*

## For physiological work

Apples  
Barley or wheat seedlings, 5-7 days old  
Beets  
Begonia  
Canna rhizome  
Elodea  
Geranium  
Hyacinth bulbs  
Impatiens, 3-8 weeks old  
Mimosa pudica; plants 2-3 months old  
Nasturtium  
Onion  
Potato tubers  
Radish seedlings, 5-7 days old  
Squash plants, 8-10 weeks old  
Sunflower, 3-8 weeks old  
Sweet potato roots  
Tradescantia, flowers and leaves  
Variegated geranium  
Yeast cultures

## For morphological work

(Items starred may be preserved)

Angiosperms—flowering branches of representative families  
Angiosperms—collection of fruits of different types  
Angiosperms—leaves of various types  
Angiosperms—roots of various types  
Angiosperms—stems of various types  
Chlamydomonas—culture  
\*Equisetum—with strobili  
\*Fern—leaves with spore sacs  
Fern—living plants  
\*Fern—rhizomes (*Pteris aquilina*)  
\*Fucus—male and female plants  
\*Marchantia—antheridial branches  
\*Marchantia—archegonial branches  
\*Marchantia—sporophytes  
\*Marchantia—thallus with cupules  
\*Moss—antheridial plants  
\*Moss—archegonial plants  
\*Moss—protonemata



- \*Moss—sporophytes
- \*Mushrooms
- \*Pine—mature ovulate cones preserved dry
  - Pine—seedlings
- \*Pine—staminate branches
  - Pine—vegetative branches
- Pleurococcus
- Powdery mildew—cultures of barley mildew
  - Powdery mildew—dried leaves of willow or lilac bearing perithecia
- Rhizopus nigricans—cultures
- \*Selaginella—with strobili
- Spirogyra—vegetative
- \*Spirogyra—zygospores
- \*Wheat rust—barberry leaves with aecidial cups
  - Wheat rust—teleuto stage on wheat preserved dry
  - Wheat rust—uredo stage on wheat preserved dry
- Zamia—entire plant
- \*Zamia—ovulate cones at two or three stages of development
- \*Zamia—staminate cone

### *Seeds*

- 2 lb. barley
- 1 lb. bean
- $\frac{1}{4}$  lb. castor bean, large seeded form
- 3 lb. corn
- 1 oz. Impatiens
- 1 oz. Mimosa pudica
- $\frac{1}{2}$  lb. nasturtium
- 4 lb. pea, any wrinkled variety
- $\frac{1}{4}$  lb. pine, large seeded form
- 1 oz. radish
- $\frac{1}{4}$  lb. squash
- $\frac{1}{4}$  lb. sunflower, giant Russian
- $\frac{1}{2}$  lb. wheat

## GENERAL BACTERIOLOGY

### *Equipment for twelve students working at the same time*

A well illuminated room with gas and running water is necessary. A desk of convenient size provided with lockers for the equipment of individual students should be provided.

## INDIVIDUAL EQUIPMENT

1	box for slides, wood cap, 12 slides .....	
6	bottles, dropping, cap. 50 cc. for stains, etc. ....	
1	cup, porcelain .....	
5	fermentation tubes, medium size .....	
2	flasks, Erlenmeyer form, cap. 100 cc. ....	
2	flasks, Erlenmeyer form, cap. 500 cc. ....	
¼	oz. cover glasses, 18 mm. square, No. 1 .....	
1	forceps, Stewart cover glass .....	
1	graduate, cylinder, 10 cc. cap. ....	
2	glass rods, 6 mm. diam. 8" long .....	
5	" platinum wire, No. 27 B & S gauge .....	
20	petri dishes, 10 mm. deep, 100 mm. diam. ....	
3	pipettes, volumetric, cap. 1 cc. ....	
1	slide, culture, hollow ground .....	
12	slides, microscopical, 25 mm. x 75 mm. ....	
100	test tubes, 16 mm. x 120 mm. ....	
1	test tube brush .....	
1	thermometer, 0 to 100 degrees C. ....	
5	tumblers, glass .....	
1	paper, lens .....	

## GENERAL EQUIPMENT

*Apparatus*

1	air pump, Chapman's .....	
1	autoclave, upright, 26"x 14" .....	
1	balance, Harvard trip with weights 1 g. to 1 k. ....	
6	boilers, double, capacity 1500 cc. ....	
1	bottle, aspirator, for distilled water, Cap. 12 litres .....	
1	bottle, aspirator, for mercuric chloride, Cap. 12 litres .....	
6	bottles, balsam .....	
12	bottles, immersion oil .....	
12	burners, Bunsen, 1 tube .....	
2	burners, Bunsen, 4 tube .....	
6	burettes, 50 cc. Cap. Grad. to 1/10 cc. ....	
	Corks, assorted sizes .....	
1	cork borer .....	
3	cups, granite iron, graduated, Cap. 1 litre .....	
2	files, triangular .....	
12	flasks, Erlenmeyer, Cap. 1000 cc. ....	
12	funnels, 6" diam. ....	
2	funnels, 2" diam. ....	

3	graduates, cylinder form, Cap. 500 cc. ....
1	ice box .....
1	incubator, preferably for electricity .....
6	kettles, granite iron, Cap. 10 litres .....
	Labels, gummed, for slides and cultures .....
3	micrometers, stage .....
12	micrometers, ocular .....
12	microscopes, with two oculars (1" and 2"), with three ob- jectives (16 mm., 4 mm., and 2 mm. oil immersion) and with a sub-stage condenser .....
	Paper, black .....
	Paper, filter, circles 6" and 8" diam. ....
	Paper, wrapping .....
12	rods, glass 1 cm. diam. 15" long .....
12	rings for supports, 3" diam. ....
1	steamer, Arnold pattern .....
1	sterilizer, hot air, Lautenschlager pattern .....
	Stoppers, rubbers, assorted sizes .....
12	supports, with triangular base and rod 30" long .....
	Tags .....
3	thermometers, 0 to 250 degrees C. ....
6	tripods, 6" diam. ....
500	grams tubing, glass, diam. 6 mm. and 8 mm. ....
50'	tubing, rubber, white, 7 mm. diam. ....
25'	tubing, rubber, red, 5 and 7 mm. diam. ....
3	spools wire, copper, assorted sizes .....

*Chemicals*

2	k. bacto-peptone .....
2	k. agar .....
100	g. alcohol, methyl .....
4	l. alcohol, ethyl .....
50	g. anilin oil .....
500	g. balsam, Canada .....
100	g. barium oxide .....
1	lb. beef extract, Liebig's in $\frac{1}{4}$ lb. containers .....
1	lb. carbolic acid .....
200	g. cedar oil for immersion .....
100	g. chloroform .....
100	g. copper sulphate, C. P. ....
25	lb. cotton batting .....
2	lb. cotton, absorbent .....
500	g. dextrose .....
50	g. diphenylamine .....

50 g. ferric chloride C. P. ....	
1 lb. formalin .....	
50 g. fuchsin .....	
2 k. gelatine .....	
50 g. gentian violet .....	
5 lb. hydrochloric acid C. P. ....	
50 g. iodine, resublimed .....	
500 g. levulose .....	
100 g. litmus, cubes .....	
100 g. maltose .....	
1 k. mercuric bichloride .....	
50 g. methylene blue .....	
25 g. naphthylamine .....	
1 lb. nitric acid, C. P. ....	
50 g. phenolphthalein .....	
50 g. potassium acid phosphate .....	
50 g. potassium iodide .....	
50 g. potassium nitrate .....	
50 g. Rochelle salts .....	
500 g. saccharose .....	
50 g. sodium chloride .....	
50 g. sodium nitrite .....	
1 lb. sulphuric acid .....	
½ lb. vaseline .....	
2 lb. xylol .....	

DEALERS IN LABORATORY APPARATUS AND SUPPLIES FOR GENERAL BOTANY  
AND GENERAL BACTERIOLOGY

Bausch & Lomb Optical Co., Rochester, N. Y. (microscopes, apparatus, chemicals); Botanical Laboratory, University of Notre Dame, Notre Dame, Ind. (microscopical preparations); Cambridge Botanical Supply Co., Cambridge, Mass. (plant material, apparatus); Eimer & Amend, New York, N. Y. (apparatus, chemicals); Henry Heil Chemical Co., St. Louis, Mo. (glassware and chemicals); Marine Biological Laboratory, Woods Hole, Mass. (plant material); M. S. Markle, Earlham College, Earlham, Ind. (microscopic slides and preserved material); The Plant Study Co., Cambridge, Mass. (microscopical preparations and plant material); E. H. Sargent & Co., Chicago, Ill. (apparatus and chemicals); Spencer Lens Co., Buffalo, N. Y. (microscopes); The Arthur H. Thomas Co., West Washington Square, Philadelphia, Pa. (apparatus, chemicals).

# ZOOLOGY

## *Equipment for ten students working at the same time \**

The list given below represents the minimum equipment with which a properly qualified teacher can be expected to conduct work of college grade. A properly qualified teacher can devise at small cost many articles of equipment, mainly home-made additions to the list. Running water and adequate drainage is an essential part of the facilities required, and gas is almost a necessity. Storage tanks lined with cement or galvanized iron are necessary for keeping living animals. It is desirable that these tanks be easily accessible, although they need not be in the laboratory room. A synoptic museum representing the phyla of the animal kingdom is a valuable adjunct which teachers should be encouraged to develop, and for which the necessary funds for jars, boxes, and cases should be provided. The furniture of the laboratory should include ample shelf and cupboard space for storing and protecting from dust all apparatus and supplies not in use. Since charts are a valuable adjunct to teaching, a beginning should be made with some collection like the Goder-Heimann series, which should be supplemented, as the department grows, by other charts, either purchased or home-made. Paper and drawing instruments are needed for making charts. Convenient dust-proof storage space is needed for a chart collection. Lantern slides have a similar value, and with the recent reduction in cost and perfection of projection devices, it should be possible to secure for the use of one or more departments a good modern lantern fitted for opaque, slide, and microscopic projection. Some provision should be made in connection with janitor or other service for assistance in caring for material and apparatus, and in collecting living material for class use.

List prices are given from which a varying discount may be expected. Owing to the war the list prices are liable to change.

## INDIVIDUAL EQUIPMENT

10 compound microscopes \$25 to \$30 each .....	\$250.00 to \$300.00
Laboratory tables, allowing a space at least 2 by 3 feet for each student and having drawers or lockers and heavy white pine or hardwood tops, \$20 to \$40 per table .....	\$40.00 to 80.00
10 pairs medium scissors .....	4.00
10 pairs fine pointed forceps .....	3.00
10 pairs heavy forceps .....	4.00
10 scalpels, medium .....	3.50

\*This list need not be substantially increased until the number of students exceeds thirty.

20 dissecting needles .....	\$ 1.00
10 dissecting lenses, one-inch focus .....	12.00
2 gross glass slides, 3x1 inches .....	2.50
4 ounces cover glasses, $\frac{3}{4}$ inch square .....	3.50
20 Syracuse watch glasses .....	1.25
20 pipettes, with rubber bulbs .....	.75
1 lot guarded bristles .....	.50
1 pkg. filter paper .....	.50
10 dissecting pans, about 6x10 inches, with wax in bottom ....	5.00

## GENERAL EQUIPMENT

1 balance, with weights .....	5.00
1 microtome and knives .....	75.00
1 microscope, with condenser and extra lenses .....	50.00
1 dissecting microscope .....	25.00
1 paraffine bath .....	50.00
1 pair field glasses, for bird study .....	10.00
1 aquarium, rectangular and with glass sides .....	10.00
2 aquarium tanks, 3 or 4 ft. square and 10-12 inches high, of cement or heavy wood, lined with galvanized iron and equipped with running water. These are for storage of living specimens .....	30.00
10 glass aquarium jars .....	15.00
10 crystallization dishes, 10-12 inches .....	15.00
20 finger bowls .....	4.00
10 stender dishes, 2 to 3 inches diameter .....	1.25
3 lb. glass tubing, assorted sizes .....	2.50
20 feet rubber tubing, assorted sizes .....	3.00
25 fruit jars, with large mouths .....	2.00
25 test tubes .....	.50
3 waste cans of galvanized iron or crocks .....	3.00
20 dropping bottles, ground stopper and pipette .....	3.00
100 vials, assorted sizes .....	3.00
50 bottles, wide mouths, assorted sizes .....	5.00
1 lot corks, assorted sizes .....	1.00
5 glass battery jars or covered crocks, for storage of larger specimens .....	4.00
10 insect boxes, \$0.50 to \$2.00 each .....	\$5.00 to 20.00
1 lot insect pins, assorted sizes .....	1.00
5 insect pinning boards, home-made .....	2.00
2 tripods .....	.50
2 Bunsen burners, for gas .....	.40
2 alcohol lamps .....	1.00
1 mortar and pestle, Wedgewood .....	.50

1 lot, glass stoppered bottles, assorted sizes .....	\$ 5.00
12 Coplin staining jars .....	4.00
3 graduates, 25, 100, 500 cc. capacity .....	1.75
1 nest of beakers, 20 to 500 cc. capacity .....	2.00
1 lot common window glass panes, assorted sizes .....	2.00
3 glass funnels, plain, 50, 100 and 150 mm. in diameter .....	.50
3 glass flasks, capacity about 500 cc. ....	.60
15 slide boxes for 1"x3" slides .....	1.25
1 lot gummed labels, assorted sizes .....	.50
2 balsam bottles .....	.50
1 minnow seine .....	3.00
3 collecting nets, mounted .....	4.00
1 pair rubber boots, for collecting .....	6.00
3 insect nets, home-made .....	.75
2 botanical collecting cans or canvas haversacks, for carrying collecting bottle and jars .....	2.00
1 lot of additional scissors, forceps, scalpels, needles, hand-lenses, glass slides, covers, watch glasses, pipettes, dissecting pans, etc., for use of teacher and for general laboratory use .....	15.00
1 lot of assorted jars, bottles and vials of clear glass, suitable for display of permanent demonstration specimens .....	15.00
4 insect cages, home-made .....	2.00

REAGENTS AND CHEMICALS

10 lbs. formalin .....	3.00
1 gal. alcohol, 95% .....	4.00
1 qt. absolute alcohol .....	2.00
1 lb. ether .....	1.75
1 lb. mercury .....	1.00
2 gals. distilled water .....	....
1 lb. glycerine .....	1.00
1 lb. turpentine .....	.50
½ lb. cedar oil .....	1.00
3 ozs. balsam, in xylol .....	.75
3 lbs. xylol .....	3.00
1 lb. glacial acetic acid .....	.75
1 lb. sulphuric acid .....	.40
1 lb. hydrochloric acid .....	.25
1 lb. nitric acid .....	.60
½ lb. picric acid, crystals .....	1.00
½ lb. corrosive sublimate .....	.75
1 lb. chloroform .....	1.00
1 lb. caustic potash .....	.50

$\frac{1}{2}$ lb. potassium cyanide, fused lumps .....	\$ .55
1 oz. iodine, resubl. ....	.75
$\frac{1}{2}$ oz. methyl green .....	.75
6 ozs. haemalum, solution .....	.75
3 ozs. acid carmine, solution .....	1.00
$\frac{1}{2}$ oz. orange G, powder .....	.60
1 oz. pith, for sectioning .....	.10
$\frac{1}{2}$ oz. optical carmine .....	.60

## DEALERS IN ANIMALS FOR CLASS WORK

F. J. Burns & Co., 214 W. So. Water St., Chicago, Ill.; A. A. Spfung, North Judson, Ind.; Alex. Nielson, Venice, Erie Co., Ohio (living and preserved material); Harpswell Laboratory, Tufts College, Mass.; Marine Biological Laboratory, Supply Department, Woods Hole, Mass. (marine specimens); Powers and Powers, Station A, Lincoln, Nebr. (living hydra, protozoa, etc. and microscopic slides).

A Zoological Supply Department is maintained by the University of Missouri for the purpose of furnishing the high schools of the state living and preserved material from the local fauna and also the marine forms ordinarily used. In addition to the forms used for student dissection, simple museum specimens and microscopic preparations may be secured. All supplies will be furnished at cost, and the schools will further have the advantage of low transportation charges and prompt delivery. This department is not in operation between June 1st and October 1st. The current price-list and further information may be obtained by addressing the Zoological Supply Dept., Biology Bldg., Columbia, Mo. If the extension of this service to include material needed by Junior Colleges seems warranted, the necessary additions to the list can be made. In all probability college teachers will find it more satisfactory to collect their own material or to order from larger dealers, unless their orders are for small amounts.

## DEALERS IN LABORATORY APPARATUS AND SUPPLIES FOR ZOOLOGY

Bausch and Lomb Optical Co., Rochester, N. Y. (microscopes and supplies); Eimer and Amend, 205-211 Third Ave., N. Y. (general apparatus, supplies and reagents); Spencer Lens Co., Buffalo, N. Y. (microscopes and supplies).

## PHYSIOLOGY

A physiological laboratory for general elementary instruction gives the best results when equipped on the basis of two students to a working unit. A maximum of four students may under some condition be made the unit basis.



GENERAL EQUIPMENT

Student tables, size of top about 34 x 54, height 34 inches..	} \$100.00
Stools, two to each table .....	
Gas, water, and electric table connections for an electric clock .....	
Electric clock, beating seconds, Harvard form with tele-graphic relay .....	
Shellac outfit .....	
Stock of artificial physiological solutions .....	

GENERAL APPARATUS FOR DEMONSTRATION

1 Tyco manometer, for blood pressure .....	25.00
1 stethoscope, Bowles .....	3.50
1 Dudgeon's sphygmograph .....	14.00
1 mercury manometer and blood pressure outfit .....	5.00
1 set of test lenses for the eye .....	30.00
Assorted glass tubing .....	1.00
Assorted rubber tubing .....	5.00
Assorted corks .....	1.00

SPECIAL SETS OF APPARATUS AND CHEMICALS

(For each unit group of students)

1 recording drum, clockwork driven .....	24.00
1 induction coil .....	7.00
1 platinum stimulating electrode .....	1.25
2 dry batteries .....	.50
1 double spring contact key .....	.50
1 muscle lever .....	1.15
1 muscle clamp .....	1.00
100 weights, 10 gram, lead .....	.30
1 heart lever, of straw .....	.00
1 heart lever holder (use muscle lever holder) .....	.00
1 set of two heart perfusion bottles .....	2.00
1 signal magnet (electric, for the time circuit) .....	1.25
1 tuning fork, 100 double vibrations a second .....	1.00
2 iron stands, heavy base (chemical stands will serve) .....	2.00
4 burette clamps, simple .....	.60
2 burette clamps, universal .....	.80
100 sheets glazed paper, 6 x 20 inches .....	.50
1 set chemical apparatus, containing 6-inch file, 100 filter papers, 4-inch funnel, Bunsen burner, 100 cc. graduated cylinder, 2 4-inch flat bottom evaporating dishes, 300 cc.	

	flask, test tube rack and two dozen test tubes, set of 6 beakers, 100° centigrade thermometer, costing in all about . . . . .	\$ 10.00
1 set	chemicals containing starch, dextrine, dextrose, acetic acid, nitric acid, hydrochloric acid, picric acid, ammonia, caustic soda or potash, sodium chloride, magnesium sulphate, ammonium sulphate, calcium chloride, copper sulphate, ammonium tartrate, glycerine, pepsin, ptylin, pancreatin and fibrin, costing in all about . . . . .	6.00
1 set	chemical reagent bottles . . . . .	8.00

## ART

### THEORY AND PRACTICE OF ART

A well-lighted room with skylight, or high windows, should be selected for the art department. The furniture is not expensive and should include individual tables, chairs or stools, and easels, with a smooth finished board for drawing and an ordinary one for modeling. The Western Stoneware Company, Monmouth, Illinois, sells modeling clay, and most of the art dealers furnish various compositions like plasticene. For the lecture purposes a good stereopticon should be furnished. Bausch and Lomb, Rochester, New York, now make at a comparatively low price a Balopticon which combines the stereopticon with an opaque projectoscope, thus enabling the instructor to use colored material. This instrument is of the highest value to the art instructor. Reproductions of the most important examples of fine arts can be purchased in the form of photographs or lantern slides, and, if a Balopticon is used, University prints, postcards, book and magazine illustrations, become very valuable lecture and study material.

It is possible for the art department to form gradually a very helpful collection of actual craft objects in pieces of pottery, textiles, etc., of good design with slight expense by watching chances to buy "seconds," yard and half yard remnants, samples, etc.

### HISTORY OF MODERN PAINTING

The equipment for the courses in history of modern painting should include a good stereopticon and screen, and lantern slides, photographs, or other reproductions of paintings of each artist whose work is discussed in class.

Lantern slides may be obtained from Detroit Publishing Co., 15 W. 38th Street, New York City; Soule Art Co., 506 West Street, Roxbury, Massachusetts; and Brown, Clement & Co., 13 W. 46th Street, New York City. Photographs may be secured from the firms named above and from W. J. Gardner & Co., 498 Boylston Street, Boston,

Massachusetts; George Busse, 12 W. 28th Street, New York City; Foster Brothers, 4 Park Square, Boston, Massachusetts; A. W. Elson & Co., School Street, Belmont, Massachusetts; and Whitcombe, McGeachin & Co., 24 W. 37th Street, New York City. Excellent and inexpensive half tones (about one cent each) may be had from Cosmos Pictures Co., 119 W. 25th Street, New York City; the Perry Pictures Co., Malden, Massachusetts; and especially from University Prints, Newton, Massachusetts. Catalogs and prices may be obtained by writing to any of these firms.

### HOME ECONOMICS

Every department of home economics should have well-equipped laboratories for food and for clothing work. Their size should depend, of course, upon the number of students to be accommodated. If a chemistry laboratory is not available, the food laboratory should be equipped for the necessary chemistry work. Since the influence of suggestion is strong, the laboratories should be arranged as attractively and as efficiently as possible.

#### FOOD LABORATORY

The food laboratory should be provided with individual equipment and sufficient general equipment, as stoves, sinks, etc., to make efficient work possible. The individual equipment costs approximately \$4.10 per student. Adequate general equipment may be purchased for approximately \$425. This includes all the equipment indicated below.

Laboratory desks in the food laboratory can be made locally or can be purchased from any of the houses supplying laboratory equipment. They vary in price, ranging from \$10 up for the unit accommodating two students, the price depending upon the kind and quality of the material, the method of construction, the finish of the top of the desk, and whether or not individual gas plates are attached.

The individual stoves may be purchased separately at from \$2.50 to \$3.50 each. The shelf type is preferable, because it takes up less space on the table top. The stoves without a solid top waste less heat by radiation.

The tops of the desks should be of impervious material not easily stained. Well-fitted hard wood, stone, tile, and various forms of composition are the types of tops most frequently used. It is a matter of economy to buy good laboratory desks.

There should be sufficient oven space for the work of each pupil. Individual ovens may be used over the individual gas burners, but since many of these are not satisfactory, they should be carefully tested before being purchased. In some laboratories such ovens are

arranged on shelves in one corner over stationary gas burners. Another alternative is to have a sufficient number of large stoves to provide oven room. A fireless cooker is desirable.

Unless the school refrigerator is available for the use of the department of home economics, a refrigerator of the household size should be provided.

There should be a storage cabinet for food materials. This should have either crockery or glass jars in which food can be kept. Nothing detracts so much from the good appearance of or the good results in a food laboratory as poor storage facilities.

Each food laboratory should have a scale of the balance type for each six students, and at least one thermometer for each two students. Chemical thermometers graduated to 250° C are the best. Microscopes should be available when needed, at least in the proportion of one to each four students. These should be equipped with sufficient slides and cover glasses.

If a chemical laboratory is available, the students can do the necessary chemical work there. It is better, however, to have a shelf along one side of the food laboratory on which the chemical work may be done. In this case, the following equipment should be provided for each two students.

- 1 Bunsen burner
- 1 25 cc. graduate cylinder
- 12 test tubes
- 1 test tube holder
- 1 test tube rack
- 4 beakers, 100 to 250 cc.
- 1 2½ inch funnel
- 1 wooden funnel holder
- 1 vial litmus paper
- 1 pkg. qualitative filter paper

The following general equipment is desirable:

- 4 burettes, 50 cc.
- 1 Babcock tester for fat
- 4 egg candler

Unless an individual kitchen is provided, one corner of the laboratory should be fitted up as a kitchen unit. If this is placed on the side of the dining room or of the room used for the service of meals, and if care is taken in fitting it up properly, it can be made almost as satisfactory as an individual kitchen. Meal preparation work in the large laboratory is liable to develop bad habits of work in the students and is less efficient on account of the size of the laboratory. The kitchen unit approaches more nearly the home conditions under which the girls will ordinarily have to work.

The following list of equipment is intended to be suggestive. The prices quoted are only approximate. In the case of such things as desks, refrigerator, supply cabinet and cupboards, cheaper equipment may be secured, if necessary. Detailed information with regard to equipment may be found in *Equipment for Teaching Domestic Science* by Helen Kinne. Whitcomb & Barrows, Huntington Chambers, Boston, Mass. The price of this book is eighty cents.

1 gas range .....	\$ 21.00
1 stove, with oven (if there is no gas) .....	10.00
8 desks, each 5 ft. long, each .....	25.00
16 stools, each .....	.75
1 sink .....	4.00
1 refrigerator .....	25.00
1 supply cabinet .....	10.00
1 grocery cupboard .....	5.00
1 china cupboard .....	10.00
1 set scales (Balance, not spring) .....	3.00
Microscopes .....	20.00
8 dishpans, each .....	.25
8 tin boxes for flour, each .....	.08
8 tin boxes for sugar, each .....	.08
8 plates for soap and sapolio, each .....	.05
8 thermometers, each .....	.30
4 shallow biscuit pans, made to fit the oven .....	.40
8 biscuit cutters, each .....	.05
1 roasting pan .....	.25
2 deep iron kettles .....	.75
2 wire baskets, each .....	.10
2 draining spoons .....	.06
1 large grater .....	.05
2 large stew kettles, each .....	.50
2 large double boilers, each .....	.25
4 ice cream freezers, 1 qt. ....	5.00
2 doz. fruit jars .....	1.50
2 doz. jelly glasses .....	2.00
8 muffin rings .....	2.00
1 meat grinder .....	1.25
1 coffee pot (percolator) .....	3.50
1 flour sifter .....	.10
1 tea kettle .....	.75
6 small tin buckets .....	.30
1 large sauce pan .....	.25
1 carving knife .....	.25

1 tea pot . . . . .	\$ .25
2 scrubbing brushes, each . . . . .	.15
40 dish cloths, linen, $\frac{1}{4}$ yard in length . . . . .	2.00
50 dish towels, linen, 1 yard in length . . . . .	7.50
16 sets of apparatus, as follows	
1 tablespoon . . . . .	.06 $\frac{2}{3}$
2 teaspoons, each . . . . .	.03 $\frac{1}{3}$
1 salt spoon . . . . .	.05
1 wooden spoon . . . . .	.05
1 fork . . . . .	.07
1 spatula . . . . .	.25
1 paring knife . . . . .	.05
1 measuring cup . . . . .	.08
1 mixing bowl . . . . .	.50
1 large baking dish . . . . .	.35
1 ramekin . . . . .	.10
1 plate, (porcelain) . . . . .	.10
1 pie tin . . . . .	.03
1 clover egg beater . . . . .	.10
1 egg whip . . . . .	.02
1 rolling pin . . . . .	.30
1 molding board . . . . .	.10
1 deep cake and bread pan . . . . .	.10
2 sauce pans, each . . . . .	.25
1 cover for sauce pans . . . . .	.05
1 frying pan . . . . .	.08
1 wire strainer . . . . .	.10
1 double boiler . . . . .	.25

There should be an equipment for the service of meals. Preferably this should be a separate dining room provided for this purpose. If this is impossible, one part of the food laboratory should be used for the service of meals, the proper equipment being provided. Dining room equipment should include table, linen, china, and silver, unless these can be obtained from the college dining room.

#### CLOTHING LABORATORY

The clothing laboratory should contain tables one yard in width and in sufficient length and number to allow at least two and one-half feet of space for each student. The tables for the clothing laboratory can be purchased from any furniture house. Three by eight feet or three by ten feet are satisfactory dimensions for the tables.

Each student should have the following individual equipment:

1 yd. ruler, metal edged

- 1 pair 6 inch scissors
- 1 tape line
- 1 pin cushion
- 1 emery
- 1 work box

These articles may be provided by the school or may be purchased by the students. For each pupil a box should be provided of sufficient size to hold the individual equipment and the material used. Unless there are lockers in which the boxes may be placed, it is well to have tin boxes fitted with lock and key.

There should be one sewing machine to each five students. A new electric machine is now on the market for about the same cost as other machines. It is very compact, the bottom portion being omitted, and it is especially desirable.

A good ironing board and an iron (preferable electric) should be provided.

There should be at least four tracing wheels for each class.

Cabinets should be provided to hold the students' work, one of which must be of sufficient height to allow for the hanging of dresses in the process of construction. These cabinets should be equipped with coat hangers.

The chemical laboratory should be available for the clothing classes as well as for the food classes.

The following list of chemical equipment should be available to each student in the clothing work:

- 12 test tubes
- 3 beakers, nested, 50 to 250 cc.
- 1 50 cc. graduated cylinder
- 3 stirring rods
- 3 watch glasses
- 3 small evaporating dishes
- 1 box litmus paper
- 1 Bunsen burner
- 1 pair crucible tongs
- 1 tripod

In addition to this individual equipment, one Burette with an iron stand should be available to each four students. The chemicals can probably be secured as needed from the department of chemistry. There should be one microscope for each four students.

**PHYSICAL TRAINING****GYMNASIUM EQUIPMENT**

24 pair Indian clubs, 1-lb. ....	\$ 12.00
Hangers for clubs .....	2.40
24 pair wooden wands, 36 in. ....	2.40
Wand rack .....	2.00
1 pair jump standards .....	7.50
3 to 6 mats, 2 in. thick, assorted sizes, (3 x 5, 5 x 5, 4 x 6)	\$50.00 to 100.00
6 stall bars @ 7 .....	42.00
Climbing rope .....	8.00
Beat board .....	6.00
Vertical ladder .....	36.00
Vaulting box .....	40.00
Spring board .....	24.00
Dozen bean bags .....	4.00
Playground ball equipment, per year .....	5.00
Basketball equipment, per year .....	12.00
Volley ball equipment, per year .....	4.00
Three to six showers. Costs depends on local conditions.	
Lockers, per unit .....	\$3.00 to 4.50
Institutions with dormitories can well do without lockers by providing a system of individual dressing booths adjacent to showers.	

**FIELD EQUIPMENT**

Basketball court .....	
Tether tennis .....	
Tennis .....	
Soccer ball .....	\$ 5.00
Space for hockey, relays, track athletics, soccer and group games .....	
Two dozen hockey sticks .....	.50
Two or three hockey balls, each .....	1.00

**DEALERS IN GYMNASIUM AND ATHLETIC EQUIPMENT**

Medart Manufacturing Co., DeKalb Street, St. Louis, Missouri; Narragansett Machine Co., Providence, Rhode Island; Schmeltzer Arms Co., Kansas City, Mo.; A. G. Spalding and Brothers, Chicopee, Massachusetts (branch house, 415 North 7th Street, St. Louis, Missouri).

When buying in quantities, institutions should secure considerable reduction from list prices given above.



### III

## SUGGESTIONS FOR THE EQUIPMENT OF LIBRARIES

### GENERAL INFORMATION

A separate room should be set apart for the library. This room should be well lighted, well ventilated, and commodious, and should be equipped with book stacks, reading tables, librarian's desk, filing cases for the catalog, and the like. The library should be open all day and should be in charge of a competent librarian. It is as important that the librarian have special training in preparation for his work as it is important that the teacher have professional training.

In order that reference work may be done with efficiency and dispatch, the library should contain all the books listed in this bulletin under "General Reference Books." The books listed in this bulletin under "Bibliography" are especially helpful to librarians in classifying, cataloging, and administering the library.

The lists of books which follow are not intended to indicate a well proportioned library. They are reference lists for the junior college courses outlined in this bulletin. The relative importance of books is indicated in a number of the lists by the use of asterisks. Books considered essential are double starred, thus \*\*; books considered next in importance are single starred, thus \*.

It is more economical for a college to purchase books for its library thru a local book store or thru some dealer who makes a specialty of supplying books to libraries than it is to purchase books directly from the publishers. The Missouri Stores Company†, of Columbia, Missouri, and A. C. McClurg and Company, of Chicago, Illinois, are among the dealers who make a specialty of supplying books to libraries. Books not published in the United States may be imported thru such firms as G. E. Stechert Company, 151 West 25th Street, New York, and Lemcke and Buechner, 30 West 27th Street, New York.

† The Missouri Stores Company has a contract with the State Department of Education to supply books at special prices to school libraries in Missouri. This Company will make special district prices in the case of junior colleges when books are purchased for library or classroom purposes. These district prices are f. o. b. Columbia with the provision that in the case of any junior college situated in Missouri, the Missouri Stores Company will prepay freight charges to the freight station nearest the college on all orders amounting to not less than \$25.00.

## PUBLISHERS

In the book lists given in this bulletin the names of publishing firms are abbreviated. The full names and addresses of these firms are as follows:

- Allyn—Allyn & Bacon, 1006 S. Mich. Ave., Chicago.  
 American—American Book Co., 330 E. 22nd St., Chicago.  
 American Acad.—American Academy of Political and Social Science, Station B, Phila.  
 Appleton—D. Appleton & Co., 533 S. Wabash Ave., Chicago.  
 Atkinson—Atkinson, Mentzer & Co., 318 W. Washington St., Chicago.  
 Badger—R. G. Badger, 194 Boylston St., Boston.  
 Bardeen—C. W. Bardeen, 317 E. Washington St., Syracuse, N. Y.  
 Bell—George Bell & Sons, London.  
 Blakiston—P. Blakiston's Son & Co., 1012 Walnut St., Phila.  
 Bobbs—Bobbs-Merrill Co., Indianapolis, Ind.  
 Brentano's—Brentano's, 5th Ave. and 27th St., N. Y.  
 Cambridge U. Press—Cambridge Univ. Press, Cambridge, England.  
 Cassell—Cassell & Co., London.  
 Century—Century Co., 353 4th Ave., N. Y.  
 Clarendon Press, Cambridge, England.  
 Comstock—Wm. T. Comstock Co., 23 Warren St., N. Y.  
 Ditson—Oliver Ditson, 150 Tremont St., Boston.  
 Dodd—Dodd, Mead & Co., Kansas City & New York.  
 Doubleday—Doubleday, Page & Co., Garden City, N. Y.  
 Dutton—E. P. Dutton & Co., 681 Fifth Ave., N. Y.  
 Ginn—Ginn & Co., 2301 Prairie Ave., Chicago, Ill.  
 Gorham—E. S. Gorham, 7 W. 45th St., N. Y.  
 Harper—Harper & Bros., Franklin Square, N. Y.  
 Heath—D. C. Heath & Co., 623 S. Wabash Ave., Chicago.  
 Herder—B. Herder, 17 S. Broadway, St. Louis.  
 Holt—Henry Holt & Co., 34 W. 33rd St., N. Y.  
 Houghton—Houghton, Mifflin & Co., 623 S. Wabash Ave., Chicago.  
 Huebsch—B. W. Huebsch, 225 5th Ave., N. Y.  
 J. H. Press—Johns Hopkins Press, Baltimore, Md.  
 Judd—Orange Judd Co., 315 4th Ave., N. Y.  
 Lea—Lea & Febiger, 706 Sansom St., Phila.  
 Lemcke—Lemcke & Buechner, 30 W. 27th St., N. Y.  
 Lippincott—J. B. Lippincott & Co., Washington Sq., Phila.  
 Little—Little, Brown & Co., 34 Beacon St., Boston.  
 Longmans—Longmans, Green & Co., 443 4th Ave., N. Y.  
 McClure—Publications handled by Doubleday.  
 McClurg—A. C. McClurg & Co., 330 E. Ohio St., Chicago.  
 McGraw—McGraw-Hill Book Co., 239 W. 39th St., N. Y.

- Macmillan—The Macmillan Co., Prairie Ave. and 25th St. Chicago.  
 Merriam—C. & G. Merriam, Springfield, Mass.  
 Merrill—Chas. E. Merrill Co., 432 4th Ave., N. Y.  
 Millet—J. B. Millet Co., 120 Boylston St., Boston.  
 Moffat—Moffat Yard & Co., 116 W. 32nd St., N. Y.  
 Novello—Novello & Co., 2 W. 45th St., N. Y.  
 Nystrom—A. J. Nystrom & Co., Chicago.  
 Open Court—Open Court Pub. Co., 122 S. Mich. Ave., Chicago.  
 Oxford—Oxford University Press, 35 W. 32nd St., N. Y.  
 Page—Page Co., 53 Beacon St., Boston.  
 Paul—Kegan, Paul, Trench, Trubner & Co., London.  
 Peck—G.. Peck, 117 Chambers St., N. Y.  
 Pott—James Pott & Co., 214 E. 23rd St., N. Y.  
 Putnam—G. P. Putnam & Sons, 2 W. 45th St., N. Y.  
 Rand—Rand McNally & Co., Chicago.  
 Routledge—George Routledge & Sons, London.  
 Row—Row, Peterson & Co., 623 S. Wabash Ave., Chicago.  
 Sanborn—B. H. Sanborn & Co., 623 S. Wabash Ave., Chicago.  
 Saunders—W. B. Saunders Co., Washington Sq., Phila.  
 Scott—Scott, Foresman & Co., 623 S. Wabash Ave., Chicago.  
 Scribner—Chas. Scribner's Sons, 608 S. Dearborn St., Chicago.  
 Schirmer—G. Schirmer, 3 E. 43rd St., N. Y.  
 Seeley—Seeley, Service & Co., London.  
 Seiler—A. G. Seiler, 1224 Amsterdam Ave., N. Y.  
 Simmons—Parker B. Simmons Co., 3 E. 14th St. N. Y.  
 Silver—Silver Burdett & Co., 218 Columbus Ave., Chicago.  
 S. P. C. K.—Society for Promoting Christian Knowledge, London.  
 Stokes—F. A. Stokes & Co., 443 4th Ave., N. Y.  
 Stechert—G. E. Stechert & Co., 151-155 W. 25th St., N. Y.  
 Teachers College—Teachers College, Columbia Univ., N. Y.  
 Van Nostrand—D. Van Nostrand Co., 25 Park Place, N. Y.  
 Warwick—Warwick & York, 19 W. Saratoga St., Baltimore, Md.  
 Whitcomb—Whitcomb & Barrows, Boston.  
 Wiley—John Wiley & Sons, 432 4th Ave., N. Y.  
 Wilson—H. W. Wilson Co., 958 University Ave., N. Y.  
 Wood—William Wood & Co., 51 5th Ave., N. Y.  
 Yale U. Press—Yale Univ. Press, New Haven, Conn.

## GENERAL REFERENCE BOOKS

### ART

- American Art Annual*. Amer. Federation of Arts, 1741 N. Y.  
 Ave., Washington, D. C. .... \$ 5.00  
 Champlain, J. D., and Perkins, C. G., *Cyclopaedia of Painters and*  
*Painting*, 4 Vols., Scribner ..... 20.00

Clement, C. E., <i>Handbook of Legendary and Mythological Art</i> , Houghton . . . . .	\$ 3.00
Reinach, S., <i>Apollo</i> (an illustrated manual of the history of art throughout the ages), new Ed., Scribner . . . . .	1.50
Sturgis, Russell and others, <i>Dictionary of Architecture and Build- ing</i> (biographical, historical, and descriptive), 3 Vols., Mac- millan . . . . .	18.00

## ATLASES

Bartholomew, J. G., <i>Literary and Historical Atlas of Europe</i> , Everyman, Dutton . . . . .	.50
Bartholomew, J. G., <i>Literary and Historical Atlas of America</i> , Everyman, Dutton . . . . .	.50
Dow, E. W., <i>Atlas of European History</i> , Holt . . . . .	1.50
Gardiner, S. R., <i>Atlas of English History</i> , Longmans . . . . .	1.50
Kiepert, H., <i>Atlas Antiquus</i> , Stechert . . . . .	1.75
Kiepert, H., and Huelson, C., <i>Forma Urbis Romae Antiquae</i> , Stechert . . . . .	1.00
Labberton, R. H., <i>Historical Atlas</i> (3800 B. C. to 1900 A. D.), Silver . . . . .	1.25
Putzger, F. W., <i>Historical School Atlas of Ancient, Mediaeval, and Modern History</i> , Lemcke . . . . .	1.25
Rand McNally, <i>Unrivalled Atlas</i> , Rand . . . . .	7.00
Rand McNally, <i>Library Atlas of the World</i> , 2 Vols., Rand . . . . .	25.00
Schreiber, Th., <i>Atlas of Classical Antiquities</i> , Macmillan . . . . .	6.00
Schreiber, Th., <i>Atlas of Ancient Classical Geography</i> , Everyman, Dutton . . . . .	.50

## BIBLIOGRAPHY AND LIBRARY SCIENCE

<i>Abridged Decimal Classification and Relative Index Revised</i> , Li- brary Bureau, Chicago . . . . .	1.50
A. L. A. <i>Booklist</i> , (Monthly) American Library Association, Chi- cago, Ill. . . . .	1.00
A. L. A. <i>Catalog of 8000 Volumes For a Popular Library</i> (well selected and classified), 1904, Washington, Superintendent of Documents . . . . .	1.00
A. L. A. <i>Catalog Supplement</i> , 1904-1911, Chicago, American Li- brary Association . . . . .	1.50
A. L. A. <i>List of Subject Headings</i> , Chicago, American Library Association . . . . .	2.50
<i>Cumulative Book Index</i> , (monthly, with quarterly and yearly cumulations), H. W. Wilson Co., N. Y. Price on application.	
Fay, L. E., and Eaton, Anne T., <i>Instruction in the Use of Books and Libraries</i> , The Boston Book Co., Boston . . . . .	2.25

Severance, H. O., <i>Library Primer</i> , The Missouri Book Co., Columbia, Mo. ....	\$ 1.25
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#### BIOGRAPHY

<i>Century Cyclopaedia of Names</i> , (Vol. 11 of <i>Century Dictionary</i> .)	
<i>Lippincott's Biographical Dictionary</i> , new Edition. Ed. by Heilprin, Lippincott .....	8.00
<i>Who's Who in America</i> , (biennial), A. N. Marquis, 440 S. Dearborn St., Chicago .....	5.00

#### DEBATING

Craig, Asa H., <i>Pros and Cons</i> , (complete debates with questions fully discussed on both sides) Hinds .....	1.50
Phelps, Edith M., <i>Debaters' Manual</i> , H. W. Wilson Co., N. Y. ....	1.00
Debaters handbook series, \$1.00 each. These handbooks, of which twenty-seven have been published, furnish bibliographies on all questions treated and give selections from magazines and from other material on various questions such as woman suffrage, municipal ownership, and the like. The H. W. Wilson Company, who publish the handbooks, loan articles printed in magazines, whether singly or collectively, at a nominal price. A library that wishes to borrow several articles on any debate question can get them from this firm.	

#### DICTIONARIES

##### *English*

<i>Century Dictionary and Encyclopaedia</i> , revised, 1911, (may be secured from dealers now for about \$30.00 in buckram binding), Century .....	\$ 75.00
Skeat, W. W., <i>Etymological Dictionary of the English Language</i> , 1910, Oxford .....	11.75
<i>Webster's New International Dictionary</i> , revised, 1913, Merriam..	12.00

##### *French*

Edgren, N., and Burnet, P. B., <i>French and English Dictionary</i> , Holt .....	1.50
<i>International French and English Dictionary</i> , Hinds .....	3.00

##### *German*

Flugel, <i>Worterbuch</i> , 2 Vols., Stechert .....	4.00
Heath, D. C., <i>German and English Dictionary</i> , Heath .....	1.50
James, W., <i>German and English Dictionary</i> , Macmillan .....	1.00
Kluge, <i>Etymologische Handwörterbuch</i> , Ed. 8, Stechert .....	2.80

*Greek*

Liddell, H. G., and Scott, R., <i>Greek-English Lexicon</i> , American..	\$ 10.00
Liddell, H. G., and Scott, R., <i>Greek-English Lexicon</i> , Intermediate Ed., American .....	3.52

*Italian*

Milhouse, J., <i>Italian English Dictionary</i> , 2 Vols., Ed., 5, Appleton.	5.50
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*Latin*

Lewis, C. I., and Short, C., <i>Harper's Latin Dictionary</i> , American.	6.00
Smith, W., and Hall, T. D., <i>English-Latin Dictionary</i> , American.	4.00

*Spanish*

Velasquez, M., <i>New Spanish and English Dictionary</i> , Appleton..	1.00
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## CLASSICAL ANTIQUITIES

Ramsay, W., <i>Manual of Roman Antiquities</i> , Scribner .....	3.00
Schreiber, Th., <i>Smaller Classical Dictionary</i> , Everyman, Dutton.	.50
Smith, W., <i>Dictionary of Greek and Roman Antiquities</i> (including the laws, domestic usages, painting, sculpture, music, drama, etc.), American .....	4.25
Walter, H. B., <i>Classical Dictionary of Greek and Roman Antiquities</i> (biography, geography and mythology), 1916, Cambridge University Press .....	6.50

## EDUCATION

Monroe, P., <i>Cyclopaedia of Education</i> , 5 Vols., Macmillan.....	25.00
United States Commissioner of Education, <i>Reports and Bulletins</i> .	

## ENCYCLOPAEDIAS

<i>Encyclopaedia Britannica</i> , 29 Vols., Ed. 11, 1910, Cambridge University Press .....	135.00
<i>New International Encyclopaedia</i> , 24 Vols., Ed. 2, 1914-16, Dodd..	120.00
<i>New International Yearbook</i> (published annually), Dodd .....	5.00

## FOLKLORE

Dasent, G. W., <i>Popular Tales from the Norse</i> , Putnam .....	2.50
Grimm, W., <i>Fairy Tales</i> , Everyman, Dutton .....	.50
<i>Mabinogion</i> , Tr. by Lady Guest, Everyman, Dutton .....	.50
Perrault, C., <i>Fairy Tales</i> , Estes .....	1.50

GAZETTEERS AND GEOGRAPHY

<i>Lippincott's New Gazetteer</i> , Lippincott .....	\$ 10.00
Mill, H. R., <i>International Geography</i> ; by 20 Authors, Ed. 3, 1909 Appleton .....	3.50

HISTORY

Brewer, E. C., <i>Historic Note Book</i> , latest Ed., Lippincott .....	3.50
<i>Harper's Encyclopaedia of U. S. History</i> , 10 Vols., second hand about .....	10.00
Haydn, J. T., <i>Dictionary of Dates and Universal Information Re- lating to All Ages and Nations</i> , Ed. 25, 1911, Putnam.....	6.50

INDEXES TO PERIODICALS

<i>A. L. A. Index to General Literature</i> , 1911, Chicago, American Li- brary Association .....	6.00
Supplement, 1914 .....	4.00
<i>Guide to Current Periodicals and Serials of the United States and Canada</i> , 1914, Ann Arbor, Mich., George Wahr .....	2.50
<i>Industrial Arts Index</i> , White Plains, N. Y., H. W. Wilson Co. (Price depends upon the number of magazines indexed, which are received by the subscribing library.)	
<i>Poole's Index</i> , not abridged, 6 Vols., Boston, Houghton.....	62.00
<i>Poole's Index to Periodical Literature</i> , abridged, Houghton ....	12.00
<i>Readers' Guide to Periodical Literature</i> , White Plains, N. Y., the H. W. Wilson Co. (This work is published monthly with monthly, quarterly, and yearly cumulations at \$12.00 a year. The quarterly numbers may be furnished to libraries which receive currently not more than twenty periodicals indexed in the <i>Guide</i> for \$4.00 a year. The <i>Annual Eclectic Catalog</i> which preceded the quarterly cumulations of the <i>Guide</i> can be purchased from the H. W. Wilson Co., for \$3.50.)	
<i>Readers' Guide Supplement</i> , White Plains, N. Y., H. W. Wilson Co.	

LITERATURE

Adams, O. F., <i>Dictionary of American Authors</i> , Houghton .....	3.00
Allibone, S. A., <i>Critical Dictionary of English Literature and of British and American Authors</i> , with supplement by J. F. Kirk, 5 Vols., Lippincott .....	17.50
Baker, E. A., <i>Guide to Historical Fiction</i> , 1914, Macmillan .....	6.00
Brewer, E. C., <i>Dictionary of Phrase and Fable</i> , New Ed., Phila. Lippincott .....	3.50
Brewer, E. C., <i>Reader's Handbook of Allusions, References, Plots and Other Stories</i> , Revised Ed., 1898, Lippincott .....	2.00

Bryant, William C., <i>New Library of Poetry and Song</i> , New York, Baker & Taylor .....	\$ 5.00
<i>Chambers' Cyclopaedia of English Literature</i> , 3 Vols., new Ed. by D. Patrick, 1902-04, Lippincott .....	12.00
Crabbe, G., <i>English Synonyms Explained in Alphabetical Order</i> , 1892, Harper .....	1.25
Fernald, J. C., <i>English Synonyms and Antonyms, with Notes on the Correct Use of Prepositions</i> , 1896, Funk .....	1.50
Cayley, C. M., <i>Classic Myths in English Literature</i> , revised Ed., 1911, Ginn .....	1.50
Granger, E., <i>Index to Poetry and Recitations</i> , 1904, McClurg.....	5.00
Moulton, C. W., <i>Library of Literary Criticism of English and American Authors</i> , 8 Vols., 1901-09, Malkan .....	40.00
Palgrave, F. T., <i>Golden Treasury; Selected from the Best Songs and Lyrical Poems in the English Language</i> , new Ed., Macmillan .....	1.00
Reddall, H. F., <i>Fact Fancy and Fable</i> (a new handbook for ready reference on subjects commonly omitted from cyclopaedias), 1899, McClurg .....	1.50
Roget, P. M., <i>Thesaurus of English Words and Phrases</i> (classified and arranged so as to facilitate the expression of ideas and assist in literary compositions), new Ed., 1909, Longmans .....	1.60
Pylands, T., <i>Chronological Outlines of English Literature</i> , Macmillan .....	2.00
Stedman, E. C., <i>American Anthology</i> , 1787-1899, 1900, Houghton .....	2.00
Stedman, Edmund C., and Hutchinson, E. M., <i>Library of American Literature</i> , 11 Vols., N. Y., Charles L. Webster & Co.....	33.00
Stedman, E. C., <i>Victorian Anthology</i> , Houghton .....	3.00
Ward, T. H., <i>English Poets</i> , 4 Vols., (Student's Edition), Macmillan .....	4.00
Warner, Charles D., <i>Library of the World's Best Literature, Ancient and Modern</i> , 31 Vols., N. Y. Warner Library Co. ....	77.50
(Can be purchased second hand for about \$30.00)	

## MUSIC

Annesley, C., <i>Standard Opera Glass</i> (detailed plots of 155 celebrated operas) new Ed., Brentano's .....	1.50
Baker, T., <i>A Dictionary of Musical Terms</i> , Ed. 12, Schirmer ..	1.00
Grove, G., <i>Dictionary of Music and Musicians</i> , revised Ed., 5 Vols. 1904-10, Macmillan .....	25.00
Upton, G. P., <i>Standard Oratorios</i> , Ed. 2, McClurg .....	1.50



POLITICAL SCIENCE

- Hart, A. B., and McLaughlin, A. C., *Cyclopaedia of American Government*, 3 Vols., 1913, Appleton .....\$ 22.50

RELIGION

- Bible, Holy Bible, American Revision, 1881-1885, Nelson ..... .75  
*Modern Reader's Bible*, Ed. by Moulton, Macmillan ..... 2.00  
 Dummelow, J. R., *Commentary on the Holy Bible by Various Writers*, Macmillan ..... 2.50  
 Fallows, S., and others, *Popular and Critical Bible Encyclopaedia and Scriptural Dictionary*, 3 Vols., Howard-Severance .... 14.00  
 Hastings, J., *Dictionary of the Bible*, Scribner ..... 5.00

SCIENCE

- Hopkins, A. A., *Scientific American Cyclopaedia of Formulas*, Munn. .... 5.00

SOCIOLOGY

- Bliss, *New Encyclopaedia of Social Reform*, N. Y., Funk, Wagnall 7.50  
*Check List of U. S. Government Documents, 1789-1909*, Sup't. of Documents ..... free  
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## LITERATURE

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Viaud, Julien, (Pierre Loti, pseud.) <i>Pêcheur d'islande</i> , Paris, Calmann-Levy .....	1.00
Voltaire, François Marie Arouet de, <i>Toleration and Other Essays</i> , Tr. with an introduction by Jos. McCabe, Putnam .....	1.25
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Zola, Émile, <i>Le travail</i> , Paris, Fasquelle .....	1.00
*Fortier, A., <i>Hist. de la littérature française</i> , Holt .....	1.00
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*Lanson, G., <i>Hist. de la lit. française</i> , Paris, Hatchette .....	1.40
<i>L'opinion, Journal de la semaine</i> , Paris .....	6.00
*Pellissier, G., <i>Précis de l'histoire de la lit. française</i> , Paris....	.80
Saintsbury, George Edward Bateman, <i>Short History of French Literature</i> , Ed. 6, Oxford Univ. Press .....	2.60
Thieme, Hugo Paul, <i>Guide bibliographique de la littérature fran- çaise, de 1800 a 1906</i> , Paris, Welter .....	4.50

#### PHONOGRAPHS

One of the most desirable aids to a correct pronunciation is the phonograph. A teacher can not possibly give all the time necessary to secure good pronunciation in an average class, but this machine proves an admirable substitute, when conscientiously and continuously used. Good companies that sell or lease phonographs and the necessary disks for the study of a modern language are The United States School of Languages, Annapolis, Md., and the International College of Languages, Putnam Building, New York. A machine with a set of elementary disks and the corresponding text can be bought for about \$45. The set of advanced records costs \$10, and a third set of difficult French words costs \$5. The same School has sets of records for Spanish.

## SPANISH LANGUAGE AND LITERATURE

Latin-American books are indicated by the Letter *L-A* in italics.

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Canepa, <i>Historia Argentina</i> , <i>L-A</i> .....	
** <i>Catalogue raisonné of Spanish Literature</i> (invaluable as a guide in selecting Spanish books and periodicals), Lemcke & Buechner.	
Cervantes, <i>Don Quixote</i> , Tr. by Motteux, 2 Vols., Macmillan ....	2.00
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**Coester, <i>The Literary History of Spanish America</i> , Macmillan, <i>L-A</i> .....	2.50
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* <i>Diccionario de la Real Academia</i> , Hernando, Madrid.	
Espora, <i>Episodios nacionales</i> , <i>L-A</i> .	
*Fitzmaurice-Kelly, J. A., <i>History of Spanish Literature</i> , Ap- pleton .....	1.50
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** <i>Gramática de la Real Academia</i> , Madrid.	
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*Hanssler, <i>Bibliographical Guide to Spanish Language and Liter- ature</i> , Witter, St. Louis.	
Hernández Cata, <i>La Juventud de Aurelio Zaldívar</i> , <i>L-A</i> .....	.90
**Hume, M. A. S., <i>Spanish Influence on English Literature</i> , Lip- pincott .....	2.00
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**Menéndez y Pelayo, <i>Las Cien Mejores Poesías</i> , Victoriano, Vic- toriano Suárez, Madrid.	
Nervo, <i>Otras vidas</i> , <i>L-A</i> .	
Orrego Luco, <i>Un Idilio Nuevo</i> , <i>L-A</i> .	
*Pequeño Larousse <i>ilustrado</i> , Librería Larousse, Paris.	
Peza, Juan de Dios, <i>Poesías escogidas</i> , <i>L-A</i> .	
**Ramsey, M. M., <i>Text-Book of Modern Spanish</i> , Holt .....	1.80
**Reyes, A., <i>Las Dos Américas</i> , <i>L-A</i> .....	3.00
Rodó, R., <i>Bolívar</i> , <i>L-A</i> .....	.30
**Ross, E. A., <i>South of Panama</i> , Century, <i>L-A</i> .....	2.40
**Ruhl, A., <i>The Other Americans</i> , Scribner's, <i>L-A</i> .....	2.00
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**Shepherd, W. R., <i>Latin America</i> , Holt, <i>L-A</i> .....	.50

\*\*Ugarte, M., *La Joven Literatura Hispanoamericana, L-A.*

\*Velasco, C., *Aspectos nacionales, L-A* .....\$ 1.20

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The use of the phonograph for supplementary practice in hearing the language is strongly recommended. Phonographs and records may be obtained from the Cortina Academy of Languages, 12 East 46th St., New York, and from other companies. Each school should have a complete equipment.

GERMAN LANGUAGE AND LITERATURE

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**Curme, G. O., <i>A Grammar of the German Language</i> , 1911, New York, Macmillan .....	3.50
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**Duden, Konrad, <i>Rechtschreibung der deutschen Sprache und der Fremdwörter</i> . (This work replaces Duden's <i>Orthographisches Wörterbuch</i> .), 9th Ed., 1915, Leipzig, Bibliographisches Institut. ....	.65
Eberhard, J. A., <i>Synonymisches Handwörterbuch der deutschen Sprache</i> , Ed. by O. Lyon, 17th Ed., 1910, Leipzig, Th. Grieben .....	3.40
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Hölzel's Wandbilder (for conversational practice), Wien, Eduard Hölzel, each .....	1.85
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*Kluge, F., <i>Etymologisches Wörterbuch der deutschen Sprache</i> , 7th Ed., 1909-1910, Strassburg, K. J. Trübner .....	2.50
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*Kluge, H., <i>Geschichte der deutschen Nationalliteratur</i> , 45th Ed., 1913, Altenburg, O. Bonde .....	\$ .65
Könnecke, G., <i>Bilderatlas zur Geschichte der deutschen National-literatur</i> , 2nd Ed., 1912, Marburg, N. G. Elwert .....	7.00
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**Vogt und Koch, <i>Geschichte der deutschen Literatur</i> , 2 Vol., 3rd Ed., 1910, Leipzig, Bibliographisches Institut .....	5.00
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**Witkowski, G., <i>Das deutsche Drama des neunzehnten Jahrhunderts</i> , 4th Ed., 1913, Leipzig, B. C. Teubner.....	.35
Witkowski, G., <i>The German Drama of the Nineteenth Century</i> , Tr. by L. E. Horning, Holt .....	1.25
**Woodbridge, Elisabeth, <i>The Drama, its Law and its Technique</i> (a lucid and succinct presentation of Freytag's <i>Technik des Dramas</i> ), Allyn .....	.80

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Collitz, Klara H., <i>Selections from Classical German Literature</i> (from the Reformation to the beginning of the Nineteenth Century), 1914, New York, Oxford .....	1.50
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Echtermeyer, Th., <i>Auswahl deutscher Gedichte</i> , Halle, 41st Ed., 1914, Buchhandlung des Waisenhauses .....	1.00
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**Goethe, Ed. by E. von der Hellen, "Jubiläums-Ausgabe", 41 Vols., Stuttgart, J. G. Cotta .....	21.00
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*Grillparzer, F., Ed. by A. Sauer, 20 Vols. in 10, Cotta .....	5.00
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Ludwig, Otto, Ed. by A. Bartels, 6 Vols. in 2, Leipzig, Hesse & Becker .....	1.25
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**Müller, F. Max, <i>The German Classics from the Fourth to the</i> <i>Nineteenth Century</i> (with biographical notes, translations into modern German, and notes), 2 Vols., 1886, New York, Scribner .....	6.00
Rosegger, P., <i>Als ich noch der Waldbauernbub war!</i> 3 Vols., Leipzig, L. Staackmann .....	.70
Rosegger, P., <i>Schriften des Waldschulmeisters</i> , Leipzig, L. Staack- mann .....	1.00



**Schiller, Ed. E. von der Hellen, 16 Vols., "Säkularausgabe," Stuttgart, Cotta .....	\$ 8.00
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<i>Sturm und Drang, Dichtungen aus der Geniezeit</i> (Gerstenberg, Leisewitz, Lenz, Klinger, Maler Müller), Ed. by Karl Freye, 4 Vols. in 2, Leipzig, Bong & Co., Goldene Klassiker-Bibliothek .....	1.00
Uhland, L., Ed. by Fischer, 6 Vols. in 3, Cotta .....	1.50

GERMAN HISTORY, GEOGRAPHY, ETC.

Baedeker, <i>Reisehandbücher</i> , Leipzig, K. Baedeker (Berlin und Umgebungen, \$0.75; Nordost-Deutschland, Nordwest-Deutschland, Rheinländer, Süd-Deutschland, \$1.50 each), Deutschland (less detailed in 1 Vol.) .....	2.25
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**Henderson, E. F., <i>A Short History of Germany</i> , 2 Vols. in 1, 1911, New York, Macmillan .....	2.50
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Poynting, J. H., and Thompson, J. J., <i>Heat</i> , Ed. 4, Griffin .....	4.00
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Poynting, J. H., and Thompson, J. J., <i>Electricity and Magnetism</i> , Ed. 2, Griffin .....	2.25
Preston, Thos., <i>Theory of Heat</i> , new Ed., Macmillan .....	6.00
Preston, Thos., <i>Theory of Light</i> , Ed. 4, Macmillan .....	4.75
Read, J. O., and Guthe, K. E., <i>College Physics</i> , Macmillan .....	2.75
Rutherford, E., <i>Radioactivity</i> , Ed. 2, Putnam .....	4.00
<i>Smithsonian Physical Tables</i> , Smithsonian Institute, Ed. 5 ....	2.00
Starling, S. G., <i>Electricity and Magnetism</i> , Longmans .....	2.00
Taylor, Sedley, <i>Sound and Music</i> , Macmillan .....	2.25
Thomson, J. J., <i>Conduction of Electricity Through Gases</i> , Cam- bridge Univ. Press .....	4.00
Thomson, J. J., <i>The Corpuscular Theory of Matter</i> , Scribner..	2.00
Thompson, S. P., <i>Elementary Lessons in Electricity and Magne- tism</i> , new Ed., Macmillan .....	1.50
Thompson, S. P., <i>Light, Visible and Invisible</i> , Ed. 2, Macmillan..	1.75
Thompson, S. P., <i>Michael Faraday</i> , Macmillan .....	1.25
Tyndall, J., <i>Heat as a Mode of Motion</i> , Appleton .....	2.50
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Watson, <i>Practical Physics</i> , Longmans .....	3.00
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Holleman, A. F., <i>Textbook of Organic Chemistry</i> , 1910, Wiley ..	2.50
Landolt, H., and Börnstein, R., <i>Physikalisch-Chemische Tabellen</i> , 1912, Berlin, Springer .....	

Cohn-Lassar, <i>Chemistry in Daily Life</i> , Ed. 4, 1909, Lippincott ..\$	1.75
Mellor, J. W., <i>Introduction to Modern Inorganic Chemistry</i> , 1914, Longmans .....	1.30
Newth, G. S., <i>Chemical Lecture Experiments</i> , Longmans .....	2.00
Norris, J. F., <i>Organic Chemistry</i> , McGraw .....	2.50
Perkin, F. M., and Kipping, F. S., <i>Organic Chemistry</i> , Lippincott	4.00
Philip, J. C., <i>Romance of Modern Chemistry</i> , Seeley .....	1.25
Smith, Alexander, <i>General Chemistry for Colleges</i> , Century ....	2.15
Sutton, F., <i>Volumetric Analysis</i> , Ed. 10, 1911, Blakeston .....	5.50
Thorp, F. H., <i>Outlines of Industrial Chemistry</i> , new Ed., Macmil- lan .....	3.75
Thorpe, T. E., <i>Dictionary of Applied Chemistry</i> , 3 Vols., Long- mans .....	48.50
Thorpe, T. E., <i>Essays in Historical Chemistry</i> , Macmillan ....	4.00
Treadwell, F. P., <i>Analytical Chemistry</i> , Tr. by W. T. Hall, 2 Vols., Wiley .....	7.00
Washburn, E. W., <i>Introduction to the Principles of Physical Chemistry</i> , McGraw .....	3.50
Wright, L., <i>Optical Projection</i> , Longmans .....	2.25

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<i>Chemical Abstracts</i> , American Chemical Society, Easton, Penn- sylvania .....	6.00
<i>Chemical News</i> , 16 Newcastle Street, London .....	6.00
<i>Journal of American Chemical Society</i> , American Chemical So- ciety, Easton, Pennsylvania .....	6.00
<i>Journal of Industrial and Engineering Chemistry</i> , American Chemical Society, Easton, Pennsylvania .....	6.00
<i>Popular Science Monthly</i> , Science Press, Sub-station 84, New York .....	1.50
<i>School Science and Mathematics</i> , Smith and Lenton, 2059 East 72d Place, Chicago .....	2.00
<i>Science</i> , Science Press, Sub-station 84, New York .....	5.00
<i>Scientific American</i> , Munn and Company, 233 Broadway, New York .....	4.00
<i>Scientific American Supplement</i> , Munn and Company, 233 Broad- way, New York .....	5.00

## BOTANY

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**Atkinson, G. F., <i>College Botany</i> , 1905, Holt .....	2.00

*Atkinson, G. F., <i>Studies of American Fungi: Mushrooms—Edible, Poisonous, etc.</i> , 1900, Ithaca, Andrus and Church .....	\$ 3.00
Bailey, L. H., and Gilbert, A. W., <i>Plant Breeding</i> , Rev. Ed., 1915, Macmillan .....	2.00
*Bateson, W., <i>Mendel's Principles of Heredity</i> , Putnam .....	3.50
Beal, W. J., <i>Seed Dispersal</i> , Ginn .....	.40
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**Bergen, J. Y., and Davis, B. M., <i>Principles of Botany</i> , 1906, Ginn .....	1.50
*Bessey, C. E., and E. A., <i>Essentials of College Botany</i> , 1914, Holt .....	2.20
*Blakeslee, A. F., and Jarvis, C. D., <i>Trees in Winter</i> , Macmillan .....	2.00
Britton, N. L., <i>North American Trees</i> , 1908, Holt .....	7.00
*Buchanan, E. D., and R. E., <i>Household Bacteriology</i> , 1913, Macmillan .....	2.40
*Caldwell, O. W., <i>Handbook of Plant Morphology</i> , 1904, Holt ..	1.00
*Campbell, D. H., <i>Lectures on the Evolution of Plants</i> , 1899, Macmillan .....	1.25
*Campbell, D. H., <i>Mosses and Ferns</i> , Rev. Ed., Macmillan.....	4.50
**Chamberlain, C. J., <i>Methods in Plant Histology</i> , Ed. 3, 1916, Univ. of Chic. Press .....	2.25
Clements, F. E., <i>Plant Physiology and Ecology</i> , 1907, Holt .....	2.00
Conn, H. W., <i>Agricultural Bacteriology</i> , Ed. 2, 1910, Blakiston..	2.50
**Conn, H. W., <i>Bacteria, Yeasts and Molds in the Home</i> , Rev. Ed., Ginn .....	1.00
Coulter, J. G., <i>Plant Life and Plant Uses</i> , 1913, American .....	1.20
*Coulter, J. M., <i>Fundamentals of Plant Breeding</i> , 1914, Appleton .....	1.50
*Coulter, J. M., and Chamberlain, C. J., <i>Morphology of Angiosperms</i> , 1903, Appleton .....	2.50
*Coulter, J. M., and Chamberlain, C. J., <i>Morphology of Gymnosperms</i> , 1910, Univ. of Chic. Press .....	4.00
*Coulter, J. M., <i>Plants—A Text-Book of Botany</i> , 1901, Appleton .....	1.25
**Coulter, J. M., Barnes, C. R., and Cowles, H. C., <i>A Text-book of Botany</i> , 1910, American .....	3.50
**Curtis, C. C., <i>Nature and Development of Plants</i> , Rev. Ed. 3, 1914, Holt .....	2.50
*Darbishire, A. D., <i>Breeding and The Mendelian Discovery</i> , 1912, Cassell .....	2.00
*Darwin, C., <i>Cross and Self Fertilization in the Vegetable Kingdom</i> , 1895, Appleton .....	2.00
*Darwin, C., <i>The Origin of Species</i> , Appleton .....	2.00
Darwin, C., <i>Animals and Plants Under Domestication</i> , Appleton .....	5.00
*Duggar, B. M., <i>Fungous Diseases of Plants</i> , 1909, Ginn .....	2.00
*Duggar, B. M., <i>Mushroom Growing</i> , 1915, Orange .....	1.50
**Duggar, B. M., <i>Plant Physiology</i> , 1911, Macmillan .....	1.60
**Gager, C. S., <i>Fundamentals of Botany</i> , 1916, Blakiston .....	1.50

*Gager, C. S., <i>A Laboratory Guide for General Botany</i> , 1916, Blakiston . . . . .	\$ .90
*Ganong, W. F., <i>A Laboratory Course in Plant Physiology</i> , 1908, Holt . . . . .	1.75
**Ganong, W. F., <i>The Living Plant</i> , 1913, Holt . . . . .	3.50
*Ganong, W. F., <i>The Teaching Botanist</i> , Ed. 2, Macmillan . . . . .	1.50
**Ganong, W. F., <i>A Text-book of Botany for Colleges</i> , Part 1, 1916, Macmillan . . . . .	2.00
**Georgia, Ada E., <i>A Manual of Weeds</i> , 1914, Macmillan . . . . .	2.00
Giltner, W., <i>Laboratory Manual in General Microbiology</i> , 1916, Wiley . . . . .	2.50
Goff, E. S., Moore, J. G., and Jones, L. R., <i>The Principles of Plant Culture</i> , 1916, Macmillan . . . . .	1.25
Green, J., Reynolds, <i>The Soluble Ferments and Fermentation</i> , Ed. 2, 1901, Cambridge Univ. Press . . . . .	3.00
**Green, J. Reynolds, <i>An Introduction to Vegetable Physiology</i> , 1911, Blakiston . . . . .	3.00
*Grout, A. J., <i>Mosses With Hand Lens and Microscope</i> , 1903, Ed. 2, author at Brooklyn . . . . .	6.25
**Grout, A. J., <i>Mosses with a Hand Lens</i> , Ed. 2, author, New Dorp. Richmond Co., N. Y. . . . .	1.75
**Haas, P., and Hill, T. G., <i>An Introduction to the Chemistry of Plant Products</i> , 1913, Longmans, N. Y. . . . .	2.25
**Haberlandt, G., <i>Physiological Plant Anatomy</i> , 1914, Macmillan . . . . .	6.50
Hard, M. A., <i>Mushrooms</i> , 1908, author, Kirkwood, Mo. . . . .	4.75
Hitchcock, A. S., <i>A Text-book of Grasses</i> , 1914, Macmillan . . . . .	1.50
**Hough, R. B., <i>Handbook of Trees of Northern States and Canada</i> , author, 1907, Lowville, N. Y. . . . .	6.00
*Jordan, E. O., <i>A Text-Book of General Bacteriology</i> , Ed. 4, 1914, Saunders . . . . .	3.00
**Jost, L., <i>Lectures on Plant Physiology</i> , 1907, Oxford Press . . . . .	6.75
*Keeler, Harriet L., <i>Our Northern Shrubs</i> , 1910, Scribners . . . . .	2.00
*Keeler, Harriet L., <i>Our Native Trees</i> , 1902, Scribners . . . . .	2.00
Leavitt, R. G., <i>Outlines of Botany</i> , 1901, American . . . . .	1.00
*Lipman, J. G., <i>Bacteria in Relation to Country Life</i> , Ed. 2, 1909, Macmillan . . . . .	1.50
*Marshall, C. E., <i>Microbiology</i> , 1911, Blakiston . . . . .	2.50
*Osterhout, W. J. V., <i>Experiments with Plants</i> , Macmillan . . . . .	1.25
Parsons, Frances T., <i>How to Know Ferns</i> , Scribners . . . . .	1.50
*Piper, C. V., <i>Forage Plants and their Culture</i> , 1915, Macmillan . . . . .	1.75
**Punnett, R. C., <i>Mendelism</i> , Ed. 3, Macmillan . . . . .	1.25
**Robinson, B. L., and Fernald, <i>Gray's New Manual of Botany</i> , Ed. 7, 1908, American . . . . .	2.50
Romanes, G. J., <i>Darwin and After Darwin</i> , Vol. I (the Darwinian theory), 1910, Open Court . . . . .	4.00



Sargent, F. L., <i>Plants and Their Uses</i> , 1913, Holt .....	\$ .75
**Schimper, A. F. W., <i>Plant Geography</i> , Tr. by Fischer, 1903, Oxford Press .....	12.75
*Scott, D. H., <i>The Evolution of Plants</i> , 1911, Holt .....	.82
**Stevens, F. L., <i>The Fungi Which Cause Plant Disease</i> , 1913, Macmillan .....	4.00
**Stevens, F. L., and Hall, J. G., <i>Diseases of Economic Plants</i> , 1910, Macmillan .....	2.00
Stevens, W. C., <i>Introduction to Botany</i> , 1906, Heath .....	1.50
**Stevens, W. C., <i>Plant Anatomy</i> , Ed. 2, Rev., 1910, Blakiston..	2.00
**Strasburger, E., and others, <i>Text-book of Botany</i> , Eng. Ed. 4, Tr. by W. H. Lang, 1912, Macmillan .....	5.00
*Vries, H. de, <i>Plant Breeding, Comments on the Experiments by Nilsson and Burbank</i> , 1907, Open Court .....	1.50
*Vries, H. de, <i>Species and Varieties: Their Origin by Mutation</i> , Ed. 2, 1906, Open Court .....	5.00
Vries, H. de, <i>The Mutation Theory</i> , 2 Vols., 1909, Open Court ....	8.00
**Walter, H. E., <i>Genetics, An Introduction to the Study of Heredity</i> , 1913, Macmillan .....	1.50
**Waters, C. E., <i>Ferns</i> , Holt .....	3.00
West, G. S., <i>A Treatise on the British Fresh-water Algae</i> , 1904, Putnam .....	3.50

In addition, various bulletins of the U. S. Dept. of Agriculture, particularly the bulletins of the Bureau of Plant Industry, Farmers' bulletins and the Dept. of Agriculture bulletins, contain valuable information and, so far as possible, should be secured.

#### GENERAL BACTERIOLOGY

*Bayliss, W. M., <i>Nature of Enzyme Action</i> , 1914, Longmans....\$	.90
**Buchanan, R. E., and Estelle D., <i>Household Bacteriology</i> , Macmillan .....	2.40
**Conn, H. W., <i>Agricultural Bacteriology</i> , Ed. 2, 1887, Blakiston ..	2.50
*Conn, H. W., <i>Bacteria in Milk and Its Products</i> , 1903, Blakiston	1.25
DeBary, H., <i>Lectures on Bacteria</i> , Ed. 2, 1887, Oxford .....	1.50
Ellis, David, <i>Outlines of Bacteriology</i> , 1909, Longmans .....	2.50
Euler, Hans, <i>General Chemistry of the Enzymes</i> , Tr. by Thomas H. Pope, 1912, Wiley .....	3.00
*Eyre, J. W. H., <i>Bacteriological Technique</i> , Ed. 2, 1913, Saunders	3.00
Fischer, Alfred, <i>Structure and Functions of Bacteria</i> , Tr. by A. Coppen Jones, 1900, Oxford .....	2.50
Fowler, G. J., <i>Introduction to Bacteriological and Enzyme Chemistry</i> , 1911, Longmans .....	2.10
*Frost, W. D., and McCampbell, E. F., <i>A Text-book of General Bacteriology</i> , 1910, Macmillan .....	1.60

*Hawk, P. B., <i>Physiological Chemistry</i> , Ed. 4, 1912, Blakiston ..\$	2.50
**Jordan, Edwin O., <i>General Bacteriology</i> , Ed. 4, 1914, Saunders	3.00
Klinnicutt, L. P., Winslow, C. E. A., and Pratt, R. W., <i>Sewage Disposal</i> , 1910, Wiley .....	3.00
**Lipman, J. G., <i>Bacteria in Relation to Country Life</i> , Ed. 2, Macmillan .....	1.25
McFarland, Joseph, <i>Pathogenic Bacteria and Protozoa</i> , Ed. 7, 1912 Saunders .....	3.50
**Marshall, C. E., <i>Microbiology</i> , Ed. 2, 1917, Blakiston .....	2.50
*Muir, Robert, and Ritchie, James, <i>Manual of Bacteriology</i> , Ed. 6, 1913, Macmillan .....	3.25
*Percival, John, <i>Agricultural Bacteriology</i> , 1910, Duckworth ..	2.00
**Prescott, S. C., and Winslow, C. E. A., <i>Elements of Water Bacteriology</i> , Ed. 3, 1913, Wiley .....	1.50
**Reed, H. S., <i>Manual of Bacteriology</i> , 1914, Ginn .....	1.25
Ritchie, J. W., <i>Primer of Hygiene and Sanitation</i> , 1913, World Book Co. ....	.70
*Russell, H. L., and Hastings, E. G., <i>Agricultural Bacteriology</i> 1915, author, Madison, Wis. ....	1.25
Russell, H. L., and Hastings, E. G., <i>Dairy Bacteriology</i> , Ginn ..	1.00
Savage, William G., <i>The Bacteriological Examination of Water Supplies</i> , 1906, Blakiston .....	2.50
*Savage, William G., <i>The Bacteriological Examination of Food and Water</i> , 1914, Putnam .....	2.25
*Savage, William G., <i>Milk and the Public Health</i> , 1912, Macmillan .....	3.25
*Smith, Erwin F., <i>Bacteria in Relation to Plant Diseases</i> , **Vols. I, 1905; II, 1911; III, 1914, Carnegie Institution, .....	15.00

## ZOOLOGY

### GENERAL WORKS

A library adequate for college work should contain not only standard text-books similar to the texts regularly adopted for the courses in zoology, but also a reasonable number of more advanced text and reference books for the regular use of the teacher and for reference by students as the need arises. Without a considerable number of such reference works and a few current journals, the work should not be attempted. It is important also that books be added each year upon the request of the teacher.

### GENERAL TEXTS

**Abbott, J. F., <i>General Biology</i> , 1914, Macmillan .....	\$ 1.10
**Borrodalle, L. A., <i>Manual of Zoology</i> , 1912, Oxford Univ. Press	4.00

**Calkins, G. N., <i>Biology</i> , 1917, Holt .....	\$ 1.75
**Crampton, H. E., <i>The Doctrine of Evolution</i> , 1911, Columbia University Press .....	1.50
**Dendy, A., <i>Outlines of Evolutionary Biology</i> , 1912, Appleton..	3.50
**Galloway, T. W., <i>Text-book of Zoology</i> , Ed. 3, 1915, Blakiston..	2.00
**Hegner, R. W., <i>College Zoology</i> , 1912, Macmillan .....	2.60
**Hegner, R. W., <i>Introduction to Zoology</i> , 1910, Macmillan ....	1.90
*Herbert, S., <i>First Principles of Evolution</i> , 1913, London, A. C. Black .....	1.25
**Hertwig, R., <i>General Principles of Zoology</i> , 1897, Holt .....	1.60
**Hertwig, R., Ed. by J. S. Kingsley, <i>A Manual of Zoology</i> , 1912, Holt .....	3.00
**Holmes, S. J., <i>Studies in Animal Behavior</i> , 1916, Badger....	2.50
**Holmes, S. J., <i>The Biology of the Frog</i> , 1906, Macmillan....	1.60
**Howes, G. B., <i>Atlas of Practical Zoology</i> , 1902, Macmillan....	2.50
*Jordan, D. S., and Kellogg, V. S., <i>Animal Life; A First Book of Zoology</i> , 1900, Appleton .....	1.20
*Jordan, D. S., and Heath, H., <i>Animal Forms: A Second Book of Zoology</i> , 1902, Appleton .....	1.20
*Jordan, D. S., Kellogg, V. L., and Heath, H., <i>Animals</i> (consisting of <i>Animal Life</i> and <i>Animal Forms</i> , bound in one volume), 1903, Appleton .....	1.80
**Jordan, D. S., and Kellogg, V. L., <i>Evolution and Animal Life</i> , 1907, Appleton .....	2.50
**Kellicott, W. E., <i>Chordate Development</i> , 1913, Holt .....	2.50
**Kellicott, W. E., <i>General Embryology</i> , 1913, Holt .....	2.50
**Kingsley, J. S., <i>Comparative Anatomy of Vertebrates</i> , 1912, Blakiston .....	2.25
**Linville, H. R., and Kelly, H. A., <i>A Text-book in General Zoology</i> , 1906, Ginn .....	1.50
*McFarland, J., <i>Biology, General and Medical</i> , Saunders .....	1.75
**Needham, J. G., <i>General Biology</i> , 1910, Comstock .....	2.60
**Needham, J. G., and Lloyd, J. T., <i>Life of Inland Waters</i> , 1916, Comstock .....	3.00
*Osborn, H., <i>Economic Zoology</i> , 1908, Macmillan .....	2.00
**Parker, T. J., <i>Elementary Biology</i> , Macmillan .....	3.50
**Parker, T. J., and W. N., <i>Practical Zoology</i> , Ed. 4, Macmillan	3.50
**Parker, T. J., and Haswell, W. A., <i>A Text-book of Zoology</i> , Ed. 2, 2 vols., 1910, Macmillan .....	9.00
*Sedgwick, W. T., and Wilson, E. B., <i>General Biology</i> , Ed. 2, 1895, Holt .....	1.75
*Shipley, A. E., and MacBride, E. W., <i>Zoology</i> , 1904, H. K. Lewis	2.75
*Smallwood, W. M., <i>A Textbook of Biology</i> , 1913, Lea .....	2.75
**Thomson, J. A., <i>The Story of Animal Life</i> , Scribner .....	1.50

*Thomson, J. A., <i>The Science of Life</i> , 1900, Stone .....	\$ 1.75
**Wilder, H. F., <i>History of the Human Body</i> , 1909, Holt .....	3.00

## LABORATORY MANUALS, ETC.

Curtis, W. C., <i>Laboratory Directions in General Zoology</i> , 1913, Co-Operative Store, Columbia, Missouri .....	.60
**Eggeling, O., and Ehrenberg, F., <i>The Fresh-water Aquarium and Its Inhabitants</i> , Holt .....	2.00
Givler, J. P., <i>Laboratory Directions in General Biology</i> , Ed. 2, 1914, Pub. by author, Winfield, Kansas .....	.75
Hargitt, C. W., and G. T., <i>Outlines of General Biology</i> , Ed. 2, 1917, Publ. Syracuse Univ., Syracuse, N. Y. ....	1.00
**Osburn, R. C., <i>The Care of Home Aquaria</i> , 1915, N. Y. Zoologi- cal Society .....	.25
Pratt, H. S., <i>Vertebrate Zoology</i> , 1905, Ginn .....	1.50
Pratt, H. S., <i>Invertebrate Zoology</i> , Rev. Ed., Ginn .....	1.25
Sigerfoos, C. P., <i>Laboratory Directions in General Zoology</i> , 1914, N. W. School Supply Company, Minneapolis .....	.50
Townsend, C. H., <i>The Cultivation of Fishes in Natural and Arti- ficial Ponds</i> , 1915, N. Y. C. The Aquarium .....	.20
*Wright, A. H., and Allen, A. H., <i>Zoology Field Note-book; Pt. I, Birds, Pt. II, Fishes, Amphibians, Reptiles and Mammals</i> , 1913, Pub. by authors, Ithaca, N. Y. ....	
**Bausch and Lomb Optical Company, and Spencer Lens Com- pany, <i>Manuals of Microscopy</i> , published as advertising mat- ter .....	

## MISCELLANEOUS INVERTEBRATES

**Calkins, G. N., <i>The Protozoa</i> , Macmillan .....	3.00
**Darwin, C., <i>The Formation of Vegetable Mould</i> , 1892, Appleton .....	1.50
**Huxley, T. H., <i>The Crayfish</i> , 1895, Appleton .....	1.75
**Jennings, H. S., <i>The Behavior of the Lower Organisms</i> , 1906, Macmillan .....	3.00
**Kellogg, J. L., <i>Shell-fish Industries</i> , 1910, Holt .....	1.75
*Marshall, C. E., <i>Microbiology</i> , 1912, Blakiston .....	2.50
*Mayer, A. G., <i>Sea Shore Life:—The Invertebrates of the New York Coast (Series N. Y. Aquarium)</i> , 1915, N. Y. C. The Aquarium .....	1.20
**Pratt, H. S., <i>Common Invertebrate Animals (exclusive of in- sects)</i> , 1916, McClurg .....	3.50

## INSECTS, ETC.

**Comstock, J. H., <i>Insect Life</i> , Comstock .....	1.75
*Comstock, J. H., <i>Manual for the Study of Insects</i> , 1909, Com- stock .....	3.75
*Ealand, C. A., <i>Insects and Man</i> , 1915, Century .....	3.50

Emerton, J. H., <i>Spiders, Their Structure and Habits</i> , 1890, Whidden . . . . .	\$ 1.50
**Fabre, J. H., <i>The Life of the Spider</i> , 1915, Dodd Mead . . . . .	1.50
**Folsom, J. W., <i>Entomology with Special Reference to its Biological and Economic Aspects</i> , 1906, Blakiston . . . . .	3.00
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**Holland, W. J., <i>The Butterfly Book</i> , 1899, Doubleday . . . . .	3.00
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EDUCATION SERIES 13

A STANDARD LIBRARY  
ORGANIZATION

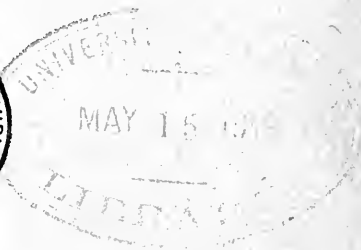
SUGGESTED FOR

MISSOURI HIGH SCHOOLS

by

HENRY ORMAL SEVERANCE

*Librarian, University of Missouri*





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## FOREWORD

The movement for better library facilities in high schools is growing rapidly. The library is so great a factor in modern teaching that no school without adequate library facilities can justly claim to be modern in its methods or to give the best returns for the money invested in it.

In the interest of establishing standards for high school libraries in Missouri, this bulletin has been prepared. In preparing it a careful study has been made of the high school libraries of the state by means of a questionnaire sent to all high schools accredited by the University of Missouri. The authorities of 179 schools replied to this questionnaire. In the following discussion references are made to the data collected and at the end of the bulletin a summary of these data is given.



# A STANDARD LIBRARY ORGANIZATION

## Suggested for MISSOURI HIGH SCHOOLS

The essential features of a standard library organization for a high school are:

1. Appropriate housing and adequate equipment;
2. Professionally trained librarians;
3. The scientific selection and care of books, the proper classification and cataloging of them, and the establishment of a serviceable loan system;
4. Adequate annual appropriations for salaries, for equipment, for supplies, for the purchase of books, for bindings, and for subscriptions for magazines.

The standard library organization varies with the size of the school. The larger the enrollment, the greater should be the library facilities. A school enrolling 500 pupils should, for instance, have more books in the library than a school enrolling 50 pupils. The library of a high school which enrolls 300 pupils should have a full-time professionally trained librarian, whereas the library of a high school which enrolls only 100 pupils can be well cared for by a teacher-librarian who has pursued a short course in library methods. A separate room is practically necessary to accommodate the library in a high school of 500 pupils, but a classroom or a section of the study hall may answer this purpose in a high school of only 50 pupils.

Since the standard library organization varies with the size of the school, high schools will, for the purpose of our discussion, be grouped into three classes based on enrollment as follows:

- I. High schools with an enrollment of less than 200 pupils;
- II. High schools with an enrollment of between 200 and 500 pupils;
- III. High schools with an enrollment of more than 500 pupils.

## I. HIGH SCHOOLS WITH AN ENROLLMENT OF LESS THAN 200 PUPILS

A more detailed discussion of the standard library organization is given in the case of this group, because in Missouri this group includes more than three times the number of schools included in the other two. Questionnaires with the desired data were returned by 127 high schools each having an enrollment less than 200 pupils.

### 1. HOUSING AND EQUIPMENT

A separate room, if possible, should be devoted to the library. If a separate room is available for this purpose, suggestions given below for Group II should be followed. If a separate room is not available for this purpose, a classroom or a section of the study hall may be used. The room should be easily accessible from the study hall—preferably adjacent to it — and should be open to students only when the librarian or her assistant is in the room.

The library room should be well lighted, ventilated, and heated. The north light is best for reading purposes. The room should be large enough to accommodate, in addition to the book stacks, the librarian's desk, a catalog case, and tables and chairs sufficient for twenty-five or thirty readers.

There should be shelving enough to provide for the present collection of books and for the probable additions in the next five years. In estimating the capacity of shelving, eight books to the foot should be used as a basis.

The shelving should be placed against the wall of the room; but, if this space is not sufficient, free standing cases with shelves on both sides may be installed. In the latter case, the passage-way between the stack and the wall should be about three feet wide.

The cases of shelves may be made of wood by a local carpenter, or steel cases of shelves may be purchased. The cases should not be over seven feet high. Those seven feet high will accommodate seven shelves. The shelves, which should be adjustable, should be three feet long and eight inches wide, ex-

cept that the bottom shelves should be twelve inches wide in order to hold folio books. The bottom stationary shelf should be placed three or four inches above the floor in order to avoid unnecessary dust. The current periodicals may be laid on their sides on the shelves in one section devoted to periodical literature, or a few pigeonholes may be made for them. For the average-sized periodical, these pigeonholes should be twelve inches high, ten wide, and twelve deep. A few larger pigeonholes may be made for folio periodicals like the *Scientific American*. If the school has sufficient funds, a periodical rack for the better display of periodicals should be purchased.

The size of the tables should depend upon the size of the room. A table ten feet long and three and one-half or four feet wide is convenient for study, and will accommodate twelve readers. Any good chairs are satisfactory, except that arm chairs take up too much room. Sheboygan chairs, costing about \$2.50 each, have been found economical and satisfactory. They should be provided with gliders or rubber tips on the bottoms of the legs. The librarian's desk and chair may be secured thru a local dealer. A flat-top desk and swivel chair cost about \$30. The desk should have drawers on both sides of the front. It should be placed near the exit so that readers must pass it on leaving the room. There should be provided also a catalog case, the number of drawers in it depending upon the probable number of books in the library after five years' expansion. One drawer affords space for 500 cards. Each book requires on an average four cards. Sectional cases of drawers are very satisfactory. If this style of case is used, a section of drawers can be added whenever needed.

The foregoing standard for the housing and the equipping of a high school library is not much higher than that maintained in the average high school library about which data were secured. Of the 127 high schools reporting, 47 have separate rooms for the library, 68 have card catalogs, and 67 have desks for the librarians.



## 2. THE LIBRARIAN

A librarian having some professional training and employed for full time is the ideal. If a full-time librarian is employed, suggestions given below for Group II should be followed. In the larger schools with enrollments of less than 200 this ideal can be realized, but in the smaller ones it may be necessary to provide "teacher librarians." The term "teacher librarian" means a high school teacher who is relieved of part of her teaching duties and placed in charge of the school library. To qualify for this work she should have, at least, a six weeks' course of training in a summer library school, or its equivalent. If college training is essential for the high school teacher, college and technical library training are essential qualifications for the librarian. A school which cannot secure a full-time librarian who has had the regular one-year course in library training in an accredited school for librarians, should have a librarian who is a college graduate with not less than six weeks' training in library science.

Only one high school reporting in the group of schools having enrollments under 200, employs a librarian who devotes all her time to the library. This school<sup>1</sup> has an enrollment of 135 students, a library of 4,796 volumes, a separate room for the library, and a card catalog and other necessary equipment. In sixty-four of the high schools reporting in this group, teachers have charge of the libraries and give a few hours a day in each case to this work. Only eleven of these teachers have had technical instruction in library science. High school pupils have charge of twenty-nine of the libraries. These student librarians are remunerated by the remission of tuition fees, by small stipends of three to five dollars a month, or by some less tangible reward. In several high schools, the position of librarian is given to students who have the highest grades in their studies.

When a teacher supervises the library, her daily schedule should be definitely arranged so that she will have regular hours for this work. Pupils should not, of course, be admitted

1. Lamar High School

to the library when no one is in charge of it, but arrangement can easily be made to have someone in charge each hour of the school day, if the teacher librarian trains one or more pupils to assist her in supervising the library.

In Wisconsin, even teacher librarians are practically required to have technical training in library science, according to the following announcement by the State Department of Public Instruction: "Beginning with the school year 1919-20, it is expected that every high school in the State of Wisconsin will employ a teacher librarian who has had the training represented by the course for teacher librarians in the State University. Necessity for this requirement is the result of the growth of the high school libraries and the responsibility of vital training which they afford when properly organized and administered."<sup>1</sup> In New York, high school librarians must have technical library training, "in as much as a district quota cannot be allowed for the service of a school librarian unless said librarian is a holder of a certificate."<sup>2</sup> Four grades of certificates are issued.

### 3. SELECTION AND CARE OF BOOKS, CLASSIFICATION, CATALOGING, ETC.

A high school with an enrollment of 200 pupils should have a library of at least 2,000 volumes, and a high school with an enrollment of 100 or fewer pupils should have a library of not less than 1,000 volumes. There should, in fact, be approximately 10 volumes for every pupil in high schools with 100 or more pupils. The sizes of the book collections in the cases of schools reporting in the group vary from 300 to 5,000 volumes. The median number of volumes, *i. e.* the number which has as many cases above as below it, is 1,000 volumes.

The efficiency of the high school library may be materially increased through co-operation with public libraries, both in the matter of books and in the matter of advice and service the librarians of public libraries may give. The pupils of thirty

1. See *American Schoolmaster*, Vol. 10, No. 10 p. 474.

2. *Library Journal*, Vol. 43, 1918, p. 717.

of the schools reporting in this group have access to public and institutional libraries.

Greater care is needed in selecting books for a small library than in selecting books for a large one. It is difficult to select the few best out of a multitude of good books. In selecting books for a high school library, it should be kept in mind that every book purchased should be useful and should render continual service.

A list of books compiled for high school libraries by good authorities are: *Library Books for High Schools*, compiled by Martha Wilson and published by the U. S. Bureau of Education, Bulletin No. 41, 1917; *Books for High School Libraries*, compiled and published by the Oregon State Library Commission, Salem Oregon; and *Bulletin on High School Libraries*, University of Illinois Bulletin, Vol. 14, No. 33. A list of the reference books which should be found in every high school library is given in chapter two of *The Library Primer*, written by H. O. Severance and published by the Missouri Book Co., Columbia, Mo. These lists simplify the work of selecting books, because all the books named in the list are good for high school libraries.

Every high school should subscribe for several good magazines for library use, some for the teachers and others for the pupils. A suggestive list of general magazines for high school libraries and a card form for recording the receipt of magazines are given in *The Library Primer*, pp. 28-29. A larger list annotated is given in F. K. Walter's *Periodicals for the Small Library*, published by the American Library Association, Chicago. In the high schools reporting in this group, the number of magazines received by the several libraries varies from 0 to thirty-two. Twenty schools receive none, and ten schools receive one each. One school with an enrollment of 380 and a library of 1,087 volumes receives one magazine; another with an enrollment of 135 receives 28 magazines; still another with an enrollment of 93 receives 25 magazines.

The processes involved in accessioning, classifying, cataloging, and installing a loan system are fully described in *The Library Primer*, pp. 28-63, and in Fay and Eaton's *The Use of*

*Books and Libraries*, published by the Boston Book Co., Boston, Mass., pp. 111, 387 *et seq.* The accession book should contain a list of all books belonging to the library. As soon as a book has been checked with the invoice and collated, it should be accessioned and then have the marks of ownership put into it. Book pockets and loan cards, as described later, should be added. Books should be arranged by classes and arranged alphabetically by authors within the classes. The Dewey decimal system is in general use. The textbook for this work is *Abridged Decimal Classification and Relative Index*, Revised, Library Bureau, Chicago, \$1.50. The books should be cataloged on cards. These cards should be arranged alphabetically by authors, subjects, and titles, forming a dictionary catalog, and should be filed in a catalog case provided for that purpose. Only fifty-eight high schools in this group reported card catalogs. Others have begun to catalog their libraries, but have not completed the work.

Every book should be provided with a pocket fastened to the inside front cover. In this pocket should be a book card, preferably 2"x5", at the top of which the name of the author and the title of the book is written. When the book is loaned for use outside the library, the borrower should sign the card, which should be kept by the librarian as his record. A charging tray should be provided. Samples of cards and pockets and of record cards may be secured by writing the Gaylord Bros., Syracuse, N. Y., and to the Library Bureau, Wabash Ave., Chicago.

#### 4. APPROPRIATIONS

There should be a definite annual appropriation, however small the amount may be, for the purchase of books, for subscriptions for magazines, for equipment, and for supplies. This annual appropriation should range from \$100 in the case of the smaller schools to \$400 in the case of the larger schools in this group. The amount should be approximately \$2 for each pupil. Schools not having a minimum library should secure, in addition to the regular annual budget, sufficient funds to install the necessary library equipment. According to *The*

*High School Visitor of Illinois*,<sup>1</sup> p. 4, the cost of a standard book and periodical equipment for a minimum library for schools with fifty pupils enrolled is \$450. For each additional fifty pupils, this amount should be increased by from \$200 to \$400. An examination of the reports by schools in this group reveals the fact that the present annual appropriations vary from \$25 to \$750. The median is \$75. Many schools have no appropriations.

## II. HIGH SCHOOLS WITH AN ENROLLMENT OF BETWEEN 200 AND 500 PUPILS

### 1. HOUSING AND EQUIPMENT

"The library must be an integral part of the high school, housed in the school building, and should not as a rule be open to the general public. The library reading room must be centrally located, well lighted, and planned appropriately with reference to general reading, reference, and supplementary study. It must be emphatically a place of refinement, comfort, attractiveness, and inspiration. The room in all its appointments should be a place essentially attractive to high school students and should be made as free of access to them as possible.

"Freedom of access to the library must imply not only freedom to consult books for reference and for supplementary and collateral study, but also freedom to read books for recreation and pleasure."<sup>2</sup>

The indispensable equipment includes all that is described under Group I. The room should be larger. It should accommodate more than fifty students at one time. There should be more tables, more chairs, more shelving, etc. Of the thirty-five schools reporting in this group, seventeen already have separate rooms for the library, twenty-five have card catalogs, and twenty-six have desks for the librarians.

### 2. THE LIBRARIAN

The duties of the librarian are manifold and the services she can render to the teachers and to the pupils are of very

1. University of Illinois Bulletin, Vol. 14, No. 33, 1917.

2. Certain, C. C., *A Standard Library Organization for Accredited Secondary Schools of Different Sizes*, p. 2.

great importance. They are far greater than merely "keeping the books." She should do much technical work such as classifying the books, instituting a loan system, making bibliographies, and indexing useful material not otherwise indexed. She should help teachers and pupils to find suitable material on special topics, provide answers for many questions that arise in the class-room and laboratory, call the attention of teachers to new books and magazine articles, and suggest to pupils books for cultural reading. In addition to this, she should select and purchase the books and supplies, direct the general policy of the library, prepare the budgets, and keep an account of library expense. Nothing can take the place of the personal work of the librarian. She should have equal rank with the high school teachers, her salary should be as large as that of the teachers of English or history, and frequently it may be necessary to pay even a larger salary in order to secure a well qualified librarian.

Every high school with an enrollment between 200 and 500 should have a full-time technically trained librarian. This librarian should have a college as well as a professional training. The school authorities should require a college training in the case of the librarian no less than in the case of the high school teachers. A college course together with a short professional course in library science is preferable to a high school course followed by a long professional course. A college or university course followed by one or two years' study in a good library school affords the ideal training for a high school librarian. Only 10 schools in the group with an enrollment of from 200 to 500 pupils reported that they employed full time librarians; 14 reported teacher librarians, five of whom have technical library training; and 6 reported student librarians.

### 3. THE SELECTION AND CARE OF BOOKS

The standard set for Group I for the selection and care of books holds also for Group II, and there should be a larger number of reference books, a larger number of books suitable for cultural reading, and a larger number for collateral read-

ing. The collections should average about 10 volumes for each pupil; a school with an enrollment of 300 pupils, for example, should have a collection of 3,000 volumes. A school of this size should add each year to its library from 300 to 400 volumes. The library should receive at least ten good current magazines in addition to bulletins, circulars, and the like. The reports reveal the fact that in Group II the libraries range from 500 to 5,740 volumes. The average is about 2,000 and the median is 1,800.

Information regarding the accessioning, classifying, cataloging, and charging of books, may be found in the discussion under Group I.

#### 4. ANNUAL APPROPRIATION

There should be a definite annual appropriation for books, magazines, supplies, and equipment, however small the amount may be. The amount should range from \$1 to \$1.50 for each pupil; a school which enrolls 300 pupils should, for example, have an annual appropriation of from \$300 to \$450.

One of the high schools reporting<sup>1</sup> may, in many ways, be taken as one of the best types of this group. This school, which enrolls 281 pupils, has a library of 1,968 volumes and receives 32 current magazines. The annual appropriation for books, magazines, and supplies is \$550. In the year for which data were reported, 210 volumes were added to the library. One room (28x22 ft.) is used exclusively for the library. It is well equipped with shelving, tables, chairs, etc. The books are selected by the librarian and the superintendent. The library is open 7½ hours a day and is in charge of a librarian, a high school teacher with technical library training, who devotes her whole time to the library.

### III. HIGH SCHOOLS WITH AN ENROLLMENT OF MORE THAN 500 PUPILS

#### 1. HOUSING AND EQUIPMENT

A separate room for the library is indispensable and should not be used for recitation purposes. This room should be adja-

1. Clinton High School.

cent to the study hall, so that pupils may easily pass from the study hall to the library. A librarian's work room adjoining the library should be provided and equipped with desk, typewriter, table, chairs, and shelves for new books in process of cataloging and for old books withdrawn for repairs and binding. The libraries should be provided with shelving for a maximum collection of from 8,000 to 10,000 volumes in the case of high schools with from 500 to 1,200 enrollment. The reading room should be provided with facilities to accommodate at one time as many as from 60 to 100 readers.

In addition to the equipment recommended for Groups I and II, the library should be provided with a charging desk, a desk for reference work, a periodical rack, a newspaper rack, bulletin boards, and a book truck.

## 2. THE LIBRARIAN

The librarian should possess all the qualifications described in the case of Group II. The minimum requirement should be graduation from a University and the satisfactory completion of a one year's course in an approved library school. In a larger high school, where the funds are available, the superintendent should secure a librarian with a few years' experience in addition to the qualifications noted above. Untrained help should be employed for the clerical work in the library such as cutting leaves and pasting labels.

## 3. THE SELECTION AND CARE OF BOOKS

A high school with an enrollment of 500 or more students should have a collection of 1,500 or more volumes with an annual increase of 500 volumes, provided the library is not a branch of the public library located in the same city. In cases where the public library establishes a branch in the school building, the permanent collection and the annual additions need not be so large. The library should subscribe for fifteen good magazines for current use. They should be bound for permanent use when the volumes are completed. The reports show that all the schools in this group are served by public libraries, and that the permanent collections range from 900



volumes to 10,631 volumes. The median is 3,300 volumes. The number of magazines received range from one to thirty-five, the median being twelve.

#### 4. ANNUAL APPROPRIATION

The annual appropriation for books, magazines, supplies, and equipment in schools of this group should range from seventy-five cents to one dollar for every student. The larger the enrollment, the lower the rate should be. The total amount should range from \$400 to \$600, unless the school makes a large use of the public library. The reports reveal the fact that in Group III the appropriations range from \$100 to \$500 in schools which accept the services of the public libraries. One school of this group where such service is not available, has an annual appropriation of \$600 for its library, which is a trifle in excess of fifty cents a pupil.<sup>1</sup> Another school that spends \$500 a year on its library has an enrollment of 769, which amounts to seventy cents a pupil.<sup>2</sup>

A fuller discussion of the library organization for high schools of this group may be found in Professor Certain's report, which has been adopted by the North Central Association of Colleges and Secondary Schools. The schools in this association will try to reach within five years the standard set in Mr. Certain's report. The report was adopted also by the National Educational Association at its latest session.

#### SOME USEFUL BOOKS ON THE ORGANIZATION AND ADMINISTRATION OF THE HIGH SCHOOL LIBRARY

1. Booth, W. J., *List of Material which may be Obtained Free or at Small Cost*, American Library Association, Chicago.
2. *Boys Books; a List of Books Boys Like*, Boy Scout Headquarters, New York City, free.
3. Certain, C. C., *A Standard Library Organization for Accredited Secondary Schools of Different Sizes*, the author, Cass Technical High School, Detroit, Mich., 20c.

1. Springfield High School  
2. St. Joseph High School

4. Dewey, M., *Abridged Decimal Classification and Relatif Index*, revised, Library Bureau, Chicago, \$1.50.

5. Fay, Lucy E., and Eaton, A. T., *Instruction in the Use of Books and Libraries*, 1915, Boston Book Company, \$2.25.

6. Oregon Library Commission, *Books for High School Libraries*, Salem, Oregon, 25c.

7. Power, Effie, *List of Books for Older Girls*, St. Louis Public Library, St. Louis, free.

8. Severance, Henry O., *A Library Primer for High Schools*, 1917, Missouri Book Company, Columbia, Mo., \$1.25.

9. Ward, Gilbert O., *The High School Library*, American Library Association, Chicago, Ill., 20c.

10. Ward, Gilbert O., *The Practical Use of Books and Libraries*, 1914, Ed. 2., Boston Book Co., Boston, Mass.

11. Wilson, Martha, *List of Books for High Schools*, U. S. Bureau of Education, Bulletin No. 41, 1917, free.

### SUMMARY OF STATISTICS

Data were not secured on all items of the questionnaire from all the schools. This fact will account for some discrepancy in the total numbers of schools reported in the several classes of data.

#### GROUP I

(135 schools reported)

##### *Enrollment*

67 schools have each an enrollment below 100

60 schools have each an enrollment above 100

##### *Number of Volumes*

3 schools have each less than 50

90 schools have each between 500 and 1,000

34 schools have each more than 1,000

##### *Annual Additions by Purchase*

80 schools added each less than 100 volumes

28 schools added each between 100 and 200 volumes

19 schools added each 200 or more volumes

##### *Annual Appropriation for the Library*

44 schools received each less than \$100

73 schools received each \$100 or more

*Periodicals Received*

- 31 schools received none
- 11 schools received 1 each
- 34 schools received from 5 to 9 each
- 19 schools received 10 or more each

*Librarian*

- 29 schools have student librarians
- 64 schools have teacher librarians, 11 of whom have received technical training

*Card Catalog and Librarian's Desk*

- 66 libraries have card catalogs
- 67 libraries have desks for the librarians

*Separate Room for the Library*

- 47 schools have separate rooms for the library

*Circulation for Home Use*

- 16 libraries issued each more than 50 volumes a day
- 28 libraries issued each 25 to 50 volumes a day
- The majority did not issue 25 volumes a day

*Instruction on Use of the Library*

- 89 schools reported that instruction is given

*Public Libraries*

- 30 public institutional libraries available for students in this group

## GROUP II

(35 schools reported)

*Enrollment*

- 23 schools have each an enrollment between 200 and 300
- 13 schools have each an enrollment between 300 and 500

*Number of Volumes in the Library*

- 5 schools have each less than 1,000
- 19 schools have each between 1,000 and 2,000
- 13 schools have each more than 200

*Annual Additions by Purchase*

- 13 schools added each less than 100 volumes
- 13 schools added each between 100 and 200 volumes
- 4 schools added each more than 200 volumes

*Annual Appropriation for the Library*

- 5 schools received each less than \$100
- 13 schools received each between \$100 and \$200
- 8 schools received each more than \$200

*Periodicals Received*

- 16 schools received each less than 10
- 14 schools received each 10 or more

*Librarian*

- 9 schools have student librarians
- 10 schools have teacher librarians all without technical library training
- 10 schools have full time librarians of whom 3 have technical library training and 4 academic training

*Card Catalog and Librarian's Desk*

- 26 schools have card catalogs
- 10 schools have desks for the librarians

*Separate Room for the Library*

- 17 schools have separate rooms for the library

*Circulation for Home Use*

- 8 schools issue 50 or more volumes a day
- 6 schools issue between 25 and 50 volumes a day
- 9 schools issue fewer than 25 volumes a day

*Instruction in the Use of the Library*

- 7 schools reported that instruction is given

*Public Libraries*

- 16 public and institutional libraries available for students in this group

## GROUP III

(14 schools reported)

*Enrollment*

10 schools have each an enrollment of 1,000 and above

*Number of Volumes in the Library*

7 schools have each more than 3,000 volumes

1 school has less than 1,000 volumes

*Annual Additions by Purchase*

7 schools received less than 200 volumes

4 schools received 200 or more volumes

*Annual Appropriation for the Library*

6 schools received \$200 or more

2 schools received less than \$200

*Periodicals Received*

6 schools received 12 or more

3 schools received less than 12

*Librarian*

6 schools have full time librarians, 3 of whom have had technical library training

5 schools have teacher librarians only one of whom has had technical library training

*Card Catalog and Librarian's Desk*

9 schools have card catalogs

10 schools have desk for librarian

*Separate Room for the Library*

8 schools have separate rooms for the library

*Circulation for Home Use*

5 schools report each 50 or more volumes a day

6 schools report each from 25 to 50 volumes a day

9 schools report each fewer than 25 volumes a day

*Instruction in the Use of the Library*

7 schools report that instruction is given

*Public Libraries*

All the schools in this group have public libraries available for student use.



EDUCATION SERIES NO. 14

J. H. COURSAULT, EDITOR



Related Science for Use in Vocational Home  
Economics Classes of Missouri  
High Schools

by

MARY L. KLINGNER

*Assistant Professor of Home Economics Education*

and

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To Dr. Louise Stanley, Chief of the Bureau of Home Economics, United States Department of Agriculture, and to Dr. Ralph K. Watkins, Assistant Professor of Education in the University of Missouri, we are indebted for helpful suggestions in preparing this bulletin. We desire to acknowledge our appreciation of their interest, encouragement, and co-operation.

Mary L. Klingner  
Lilian Sensintaffar

Columbia, Missouri,  
Sept., 1924.

# Related Science for Use in Vocational Home Economics Classes of Missouri High Schools

An important problem for a state having Federal aid for vocational education is the making of courses of study. In the curriculum for vocational home economics, related science is included. According to the plan adopted for Missouri, one-third of each half school day during the first year is devoted to the study of related science. The following outline has been prepared to assist teachers in organizing the course in this subject.

This outline is the result of experimentation during two years under the supervision of Miss Mary L. Klingner with classes in the University High School, an institution conducted under the direction of the School of Education of the University of Missouri. In the first year, the classroom work in related science was taught during the first semester by Miss Klingner, and in the second semester by two student teachers. During the entire second year, this class was taught by Miss Lilian Sensintaffar, an instructor in the Department of Home Economics. All of the work was done in the foods laboratory, to which some equipment needed to supplement the regular equipment of the laboratory was added.

The work in related science was arranged about large projects or problems, which involve a number of smaller problems. The larger units of study were distributed among various groups of pupils, who studied the smaller problems involved. Group discussions, demonstrations, and reports, through which each member of the class learned what was done and the conclusions reached, were then conducted in class meetings.

It is an ideal condition to have the science units or projects precede that home economics work which can be understood better in the light of a knowledge of the scientific principles involved. This method is not always possible, nor have the authors been able in all instances even to parallel the home economics work with the related science. They hope that these difficulties eventually will be overcome.

This outline is not detailed, nor does it contain all the problems involved in the "job" of home-making, together with the scientific principles needed in solving them. It includes in the questions, subject matter, and suggested experiments, the scientific principles which can be developed by readings and discussions, and it includes also the experiments necessary to carry out the projects.

The authors do not consider this outline a completed product. Although no outline or course of study will fit the needs of any group of teachers, it is hoped that these suggestions will guide individual teachers in planning work for their own communities. When the scientific principles are discovered, they must be applied to the regular home economics problems from time to time. The skillful teacher will be alert for opportunities to make such applications.

### List of Problems and Projects

1. How shall I care for the fruits and vegetables this fall in order to have a supply for our lunch room during the school year?
2. To freeze ice cream and other desserts.
3. To make a fireless cooker or a substitute for a vacuum bottle.
4. To make an iceless refrigerator.
5. To learn to make good quick breads.
6. To learn to make good yeast breads (a) by the long process, (b) by the short process.
7. To make good candies and cake icings.
8. How shall I care for and prepare milk for use in the home?
9. How can I find out what food elements are present in the foods which I eat, in order to plan my meals properly?
10. How does the food which I eat become a part of my body?
11. In our home we shall need fats and oils for making cake, pastry, and salad dressing, for frying croquettes, for table use, and for oiling machinery. Which is better for each purpose? Why?
12. How can I utilize the grease and fat which accumulate in our home?
13. What kind of water is best for us to drink? Why?
14. What are the best kinds of metals to use in the home, and how should they be cared for?
15. To launder my clothes.
16. How shall I remove the soiled spots from my woolen and silk clothing?
17. To dye material for a dress, or for curtains for my room.
18. When buying clothing and house furnishings how can I tell whether the materials are pure wool, pure silk, pure linen, or a combination of two or more of these fibers?
19. What must I know about fabrics in order that I may select them wisely for my clothing and household furnishings?
20. To learn to weigh and measure the materials which we use to prepare food, clothing, and shelter.
21. To learn what factors influence the boiling point of a liquid.
22. What kind of fuel is best to use in my home? Why?
23. What system of heating should we use in the new house we are building?
24. Is our house well ventilated? If not, what must we do in order that the ventilation will be good?
25. What system of lighting is best to use in my home?

*A suggested method for carrying out a project and sample lessons follow the outline of projects.*

1. Project: How shall I care for the fruits and vegetables in order to have a supply for the lunch room during the school year?

Questions:

1. What causes fruits and vegetables to spoil?
2. How can food spoilage be prevented?
3. What causes vegetables and fruits to shrink when put in a strong sugar or salt solution?
4. What will happen if too much sugar is added to jelly? Too little sugar?
5. When should sugar be added to jelly? Why?

Subject Matter	Laboratory Experiments	References
I. Food spoilage caused by 1. Microorganisms a. Bacteria b. Yeasts c. Molds 2. Emzymes	I. Can fruit and vegetables by (1) open-kettle method (2) cold pack process.	Conn, <i>Bacteria, Yeasts, &amp; Molds</i> . Powell, <i>Successful Canning &amp; Preserving</i> .
II. Distinctions between bacteria, yeasts, molds, enzymes	II. Dry fruit and vegetables.	Farmers Bull. U. S. D. A.* No. 1211, <i>Home Canning of Fruits &amp; Vegetables</i> .
III. Conditions favorable for growth of 1. Microorganisms a. Food b. Moisture c. Proper temperature 2. Enzymes a. Proper temperature	III. Make jelly.  IV. Make preserves.  V. Make pickles.	U. of Mo. Bull., <i>Preservation of Food in the Home</i> .  Farmers Bull., U.S.D.A., No. 839, <i>Home Canning by the One-Period Cold Pack Method</i> .
IV. Food spoilage prevented by 1. Heat as used in canning 2. Cold a. Cold storage b. Refrigeration c. Cellars 3. Dehydration—Evaporation to such an extent that bacteria cannot grow	VI. Make sauer kraut.	Van Rensselaer, Rose & Canon, <i>Manual of Home-making</i> , Ch. 34.  Clark, <i>Introduction to Science</i> , 41-42, 110-111.  Snyder, <i>Everyday Science with Projects</i> , 100-106.  Bailey, <i>Sanitary &amp; Appl'd Chemistry</i> , 358-363.

\*U. S. Department of Agriculture.

## (PROJECT 1—continued)

4. Chemicals		Butler, <i>Household Physics</i> , 33-34, 44.
a. Harmless		Lynde, <i>Physics of the Household</i> , 144-147.
1. Sugar		
2. Salt		
3. Spices		
b. Harmful		
1. Acids		
2. Formaldehyde		

2. Project: To freeze ice cream and other desserts.

## Questions:

1. Why is salt used with ice in freezing mixtures?
2. What proportion of salt and ice should be used? When should this proportion be changed?
3. How does the proportion of the ice and salt used affect the texture of the finished product?
4. Give reasons for the use of various kinds of materials in the construction of an ice cream freezer.
5. Compare the construction and principles of the ice cream freezer with those of the refrigerator.
6. What determines the amount of expansion in ice cream?
7. How should the freezing process be regulated so as to produce the greatest amount of expansion?

Subject Matter	Laboratory Experiments	References
I. Ingredients needed for freezing ices	I. Make Philadelphia and French ice cream.	Smith & Jewett, <i>Intro. to Study of Science</i> , 150
1. Ice		
2. Salt		Lynde, <i>Physics of the Household</i> , 135-136.
II. Purpose of each	II. Make plain water ice.	
III. Proportions vary, depending upon		Clark, <i>Intro. to Science</i> , 49.
1. Volume of liquid to be frozen	III. Make sherbet, using egg white or gelatin.	Brechner, <i>Household Physics</i> , 13-14
2. Texture desired		
3. Ingredients		Wellman, <i>Food Study</i> , 90-94.
4. Proportion of ingredients	IV. Make frappe.	
5. Purpose: freezing or packing		Fed. Bd. for Voc. Ed. Bull. No. 35, <i>Use &amp; Prep. of Food</i> , 70-72, 163-165.
IV. Equipment for freezing	V. Make mousse or parfait.	
1. Container for the liquid: good conductor		<i>Ice Cream Making and Appliances in the Home.</i>
2. Container for salt & ice mixture:		

## (PROJECT 2—continued)

poor conductor		Nat'l. Ass'n. of Ice Industries, Chicago.
V. Principles of an ice cream freezer and purpose of each part		
VI. Technique of freezing	<i>Suggested Field Trips</i>	
1. Expansion of liquid when frozen: affected by rate of turning, and by amount of space left in container, within certain limits	1. Visit an ice plant. 2. Visit a dairy where ice cream is made.	

3. Project: To make a fireless cooker or a substitute for a vacuum bottle.

## Questions:

1. What materials are best to use for the various parts of a fireless cooker? Why?
2. Of what are the hot plates made? Why?
3. What is the difference in principles between the fireless cooker and the thermos bottle?

Subject Matter	Laboratory Experiments	References
I. Materials	I. Make a fireless cooker.	Farmers' Bull. No. 771, <i>Homemade Fireless Cookers &amp; Their Use</i> .
1. Kind of materials best suited for following parts:		Clark, <i>Intro. to Science</i> , 30.
a. For case and cabinet	II. Make a substitute for a thermos bottle.	Snyder, <i>Everyday Science with Projects</i> , 585-589, 593-595.
b. For lining case		Butler, <i>Household Physics</i> , 66-67.
c. For packing material		Van Rensselaer, Rose & Canon, <i>Manual of Home-making</i> , 214-218.
d. For cooking compartment		Greer, <i>School &amp; Home Cooking</i> , 96-97.
e. For cooking utensil		Pirie, <i>Science of Home-making</i> , 67-69.
f. For collar		
g. For cushion		
h. For hot plates		
II. Construction		
III. Principles underlying construction and use of fireless cooker		

## 4. Project: To make an iceless refrigerator.

## Questions:

1. How is food kept cool in an iceless refrigerator?
2. How is water kept cool by persons crossing a desert?
3. Why does alcohol feel colder to the hand than water?
4. Why does the athlete wrap a blanket around himself when he finishes a game?

Subject Matter	Laboratory Experiments	References
I. Materials	I. Make an iceless refrigerator.	Snyder, <i>Everyday Science</i> , 591-593, 100-108.
II. Construction		Van Buskirk & Smith, <i>Science of Everyday Life</i> , 93.
III. Principles underlying construction and use of an iceless refrigerator		Clark, <i>Introduction to Science</i> , 41-42. Butler, <i>Household Physics</i> , 33-34. Frederick, <i>Household Engineering</i> , 55, 479.

## 5. Project: To learn to make good quick breads.

## Questions:

1. What makes bread rise?
2. What types of baking powder are there, and how do they differ?
3. What kind of substances free gas from soda? What is this gas?
4. At what temperature should the ingredients be combined and kept before baking? Why?
5. Using 1 c. flour, which requires more soda, to make gingerbread or muffins? Why?
6. What factors influence the temperature required for baking batter and dough mixtures?

Subject Matter	Laboratory Experiments	References
I. Leavening agents	I. Make popovers. Make other thin batters, if desired.	Smith & Jewett, <i>Intro. to Study of Science</i> , 63-64
1. Kinds		
a. Steam	II. Make muffins, using both sweet and sour milk. Determine how much soda is required to neutralize a given amount of sour milk.	Bailey, <i>San. &amp; Appl'd Chem.</i> , 203-212.
b. Air		
c. Carbon dioxide gas		
2. Source		
a. Water		
b. Air		Wellman, <i>Food Study</i> , 221-241.
c. Chemicals		



## (PROJECT 5—continued)

• 1. Baking powder 2. Soda		
II. Ingredients Flour, fat, liquid, leavening, salt, egg(?) flavor (?)	III. Make gingerbread.	Forster & Weigley, <i>Foods &amp; San.</i> , 223-237.  Clark, <i>Intro. to Science</i> , 148-152.
III. Proportions Based on 1. c. flour, they vary according to	IV. Make biscuits, using different types of baking powder to test for the best	Snell, <i>Ele. Household Chem.</i> , 35.
a. Kind of flour b. Kind and amount of liquid c. Type of product, as	kind; also, test for the best temperature for mixing ingredients, and baking.	Trafton, <i>Science of Home &amp; Community</i> , 98-103.
1. Popovers 2. Griddle cakes 3. Waffles 4. Muffins 5. Gingerbread 6. Drop biscuit 7. Rolled biscuit		Brownlee <i>et al.</i> , <i>Chem. of Common Things</i> , 272-275.  Fed. Bd. for Voc. Ed. Bull. No. 35, <i>Use &amp; Prep. of Food</i> , 126-206.
IV. Oven control		
V. Temperatures desirable		
1. Popovers—250°C. 2. Griddle cakes & muffins—smoking hot iron. 3. Muffins—225°C. 4. Gingerbread—195°C. 5. Biscuits—225°C.		Pirie, <i>Science of Home-making</i> , 195-206  Greer, <i>Textbook of Cooking</i> , 199-202

6. Project: To learn to make good yeast breads (a) by the long process; (b) by the short process.

Questions:

1. What is the difference between the long and the short process?
2. What kinds of flour may be used in making yeast breads? Which is best? Why?
3. What are the standard proportions for one loaf of bread, and how vary them for rolls? For fancy breads?
4. What relation has the temperature during the rising process to the texture and flavor of the bread?
5. What relation has the temperature of the oven to texture and flavor?
6. How should your bread be cared for after it is baked?
7. Which will produce the more gas in the same length of time, one cake of dry yeast or one cake of compressed yeast? Why? What is the gas?

## 8. How do yeast cells grow?

Subject Matter	Laboratory Experiments	References
I. Ingredients used 1. Flour 2. Liquid 3. Leavening 4. Fat 5. Salt	I. Make bread, using same proportions, but varying ingredients by using (1) dry yeast, (2) same amount of compressed yeast	Forster & Weigley, <i>Foods &amp; San.</i> , 220-223, 242-252.  Wellman, <i>Food Study</i> , 234-235, 244-253.
II. Proportions— Read and experiment to find these	II. Make bread, varying ingredients by using	Wellman, <i>Food Planning &amp; Prep.</i> , 284-289.
III. Kind & Source of leavening 1. Kind-carbon dioxide 2. Source: yeast	(1) hard wheat flour (2) soft wheat flour (3) graham flour (4) rye flour	Van Buskirk & Smith, <i>Science of Everyday Life</i> , 191-192.
IV. Conditions necessary for growth of yeast: 1. Food 2. Moisture 3. Proper temperature	III. Make rolls, varying ingredients and proportions used in bread	Hunter, <i>Civic Biology</i> 136-139.  Brechner, <i>Household Physics</i> , 48.
V. Method of mixing ingredients & manipulation 1. Short process 2. Long process	IV. Make fancy breads, such as cinnamon rolls, Swedish tea rings, sally lun, raisin bread, etc.	Snell, <i>Ele. Household Chemistry</i> , 57 Farmers Bulletins, Nos. 1136, 807; Univ. of Mo. Bull., <i>Making Lightbread</i> , Addie Root.
VI. Temperature 1. Room about 85° F. 2. Ingredients same temperature 3. Oven 425°-450° at first; lower to 380° at last.		Smith & Jewett, <i>Intro. to Science</i> , 64. Butler, <i>Household Physics</i> , 55.

## 7. Project: To make good candies and cake icings.

## Questions:

1. What is the effect of dry heat on sugar?
2. What is the effect of moist heat on sugar?
3. Why is an acid often added to candy?
4. Why do some people add Karo?
5. What is the purpose of egg white and gelatin in candy?
6. Why is candy beaten or pulled? What will determine the best time for doing this?
7. What is the difference between candy beaten hot and beaten cold? Why?
8. How vary divinity to make good cake icing?
9. What causes the difference in texture between brittle, fudge, taffy, and divinity?

Subject Matter	Laboratory Experiments	References
<p>I. Effect of dry heat on sugar</p> <ol style="list-style-type: none"> <li>1. Stages               <ol style="list-style-type: none"> <li>a. Sugar melts</li> <li>b. Amber color: barley sugar</li> <li>c. Caramel</li> <li>d. Carbon</li> </ol> </li> <li>2. Characteristics               <ol style="list-style-type: none"> <li>a. Will not recrystallize when cold</li> <li>b. Changes in texture and flavor</li> </ol> </li> </ol>	<p>I. Make brittle candy. Leave small portion of candy in pan. Continue heating and note changes suggested in subject matter.</p>	<p>Fed. Bd. Bull. No. 35, <i>Use &amp; Preparation of Food</i>, 150-157.</p> <p>Pirie, <i>Science of Home-making</i>, 235.</p> <p>Forster &amp; Weigley, <i>Foods &amp; Sanitation</i>, 79-92.</p> <p>Wellman, <i>Food Study</i>, 159-167.</p>
<p>II. Effect of moist heat on sugar</p> <ol style="list-style-type: none"> <li>1. Hydrolysis occurs, changing cane sugar to glucose and fruit sugar</li> <li>2. Amount of hydrolysis depends upon               <ol style="list-style-type: none"> <li>a. Proportion of liquid to sugar</li> <li>b. Length of time of cooking</li> <li>c. Amount of surface exposed</li> </ol> </li> <li>3. Amt. of hydrolysis determines size and number of crystals</li> <li>4. Acid acts as catalyst, hastening hydrolysis</li> <li>5. Addition of glucose insures small crystals</li> </ol>	<p>II. Make fudge in following ways:</p> <ol style="list-style-type: none"> <li>1. Use following ingredients: <math>\frac{1}{2}</math> as much liquid as sugar. Pour part out and beat while hot. Let remainder cool and beat.</li> <li>2. Repeat (1), adding cream of tartar.</li> <li>3. Repeat (1), adding Karo. Compare results.</li> </ol>	<p>Snell, <i>Ele. Household Chem.</i> 181.</p> <p>Brownlee <i>et al.</i>, <i>Chem. of Common Things</i>, 236-237.</p> <p>Bailey, <i>Sanitary &amp; Applied Chem.</i>, 235-236.</p>
<p>III. Effect of manipulation on moist heat and sugar</p>	<p>II. Make taffy.</p>	
<p>IV. Effect on texture and size of crystals of the following substances</p> <ol style="list-style-type: none"> <li>1. Egg white</li> <li>2. Gelatin</li> <li>3. Gum arabic</li> </ol>	<p>IV. 1. Make divinity. 2. Make marshmallows.</p> <p>V. Make cake icings.</p>	

8 Project: How shall I care for and prepare milk for use in my home?

Questions:

1. At what temperature should milk be kept? Why?
2. Why do bacteria thrive in milk?
3. Given the same conditions, which will keep sweet longer, pasteurized milk or condensed milk? Why?
4. What is junket? Why does it coagulate milk?
5. By what other means is milk coagulated?
6. At what temperature should milk be cooked? Why?
7. If you remove the scum from your cocoa, will it form again?

Subject Matter	Laboratory Experiments	References
I. Composition of milk	I. Find the food elements in (1) raw milk, (2) evaporated milk, (3) dried milk. Compare.	Peabody & Hunt, <i>El Biology</i> , 38-39, 46-47.
II. Care of milk	II. Pasteurize milk.	Fed. Bd. Bull. No. 35, <i>Use &amp; Prep. of Food</i> , 58-63.
1. Cleanliness	III. Sterilize milk.	Brownlee, <i>Chem. of Common Things</i> , 278-292.
a. Surroundings		Wellman, <i>Food Study</i> , 268-277
b. Workers		Forster & Weigley, <i>Foods &amp; Sanitation</i> , 137-158
c. Utensils		Greer, <i>School &amp; Home Cooking</i> , 163-190.
2. Sanitation		Wellman, <i>Food Planning &amp; Prep.</i> , 60-64, 153-154, 234-235.
a. Cows free from disease		
b. Workers free from disease		
III. Diseases transmitted by milk, and precautions necessary to prevent diseases		
IV. Forms in which milk may be bought		
1. Raw		
2. Pasteurized		
3. Certified		
4. Evaporated or condensed		
5. Dried		
V. Action of rennin on milk	IV. Make junket, using	
1. Conditions necessary for clotting	(1) raw milk,	
a. Proper temperature	(2) boiled milk,	
b. Calcium salts in solution	(3) dried milk,	
	(4) evaporated milk.	
VI. Effect of acid on casein of milk	V. Make cream of tomato soup. Combine ingredients	
	(1) at boiling point,	
	(2) after cooling.	

## (PROJECT 8—continued)

VII. Effect of boiling temperature on milk		
1. Precipitation of calcium salts		
2. Destruction of vitamins		
VIII. Cause and prevention of scum on heated milk	VI. Make cocoa.	
IX. Souring of milk		
1. Cause		
2. Conditions favoring		
3. Changes brought about by souring		
X. Effect of heat on sour milk	VII. Make cottage cheese.	
	<i>Suggested Field Trip</i>	
	Visit a dairy.	

9. Project: How can I find out what food elements are present in the foods which I eat, in order to plan my meals properly?

Questions:

1. What food elements are found in potatoes, rice, beans, lean meat, apples, celery, and other similar foods?
2. What is the difference between the food elements found in green bananas and ripe bananas? Why?
3. How do the food elements found get into the plant?

Subject Matter	Laboratory Experiments	References
I. Foods contain	I. Test typical articles of food for protein, starch, sugar, fat, minerals.	Dowd & Jamieson, <i>Food &amp; its Functions</i> , 3.
1. Water		Peabody & Hunt, <i>Ele. Biology</i> , H. B., 44-63.
2. Protein	II. Read about vitamins.	Hunter, <i>A Civic Biology</i> , 60-62
3. Starch	III. Perform experiments to show effect of photosynthesis.	Snyder, <i>Everyday Science with Projects</i> , 426-433.
4. Sugar		Tower & Lunt, <i>Science of Common Things</i> , 34-42.
5. Fat		
6. Minerals		
7. Vitamins		
II. Tests for food substances		
1. Protein—Add nitric acid and ammonia to food. Yellow color indicates protein.		

## (PROJECT 9—continued)

2. Starch—Add iodine. Blue color indicates starch.		Rose, <i>Feeding the Family</i> .
3. Sugar—Boil food in water+HCl. Add Fehling's solution. Reddish brown precipitate shows presence of sugar.		Willard & Gillett, <i>Dietetics for High Schools</i> .
4. Fat—Stir food with ether or benzine. Let stand 10 minutes. Filter. Allow ether to evaporate. Fat will remain.		
5. Minerals—Burn sample of food. Residue which will not burn is mineral matter.		

10. Project: How does the food which I eat become a part of my body?

Questions:

1. What changes take place in the food which I eat?
2. What causes these changes?
3. Why do these changes occur?
4. How does the digested food get out of the alimentary tract?
5. How is it carried to the body tissues?

Subject Matter	Laboratory Experiments	References
I. Purpose of digestion	I. Digestion of starch. Into a clean test tube put some starch paste solution.	Stiles, <i>Nutritional Physiology</i> , 54-136.
II. Organs of digestion	Add saliva, shake, warm gently. Test with Fehling's solution. Result.	Jordan, <i>Principles of Human Nutrition</i> , 84-141
1. Mouth		Ritchie, <i>Human Physiology</i> , 88-120.
2. Esophagus		
3. Stomach		
4. Small intestine		
5. Large intestine		
III. Digestive juices	II. Digestion of protein. Into one test tube put some minced white of egg and .2 % hydrochloric acid. Into a second put minced white of egg, .2% HCl and some pepsin. Keep at blood temperature several hrs. Make biuret test. Explain.	Hough & Sedwick, <i>The Human Mechanism</i> , 91-134
1. Saliva		Hunter, <i>A Civic Biology</i> , 296-328.
2. Gastric juice		
3. Pancreatic juice		
4. Intestinal juice		
IV. Enzymes		Hunter, <i>Lab. Prob. in Civic Biol.</i> , 220-231.

## (PROJECT 10—continued)

V. Factors in digestion		
1. Mechanical		
a. Chewing food	III. Digestion of oils and fats—Shake together oil and water. Add a little alkaline substance, e. g. baking soda. Shake.	Peabody & Hunt, <i>Ele. Biology</i> , H..B. 82-121.
b. Churning of food		Peabody, <i>Studies in Physiology</i> , 75-116.
c. Peristalsis		
2. Chemical		
a. Digestive juices & enzymes		Gruenberg, <i>Elementary Biology</i> , 78-88.
VI. Absorption	Note: Many other good experiments may be found in the references.	
1. Purpose of absorption		Snell, <i>Ele. Household Chemistry</i> , 201-206.
2. Conditions favoring absorption		
a. Moist absorbing membrane		
b. Rich supply of blood & lymph vessels		
c. Digested food must be for some time in contact with absorbing surface		
VII. Use of food by cells		
1. Oxidation		
2. Storage		

11. Project: In our home we shall need fats and oils for making cake, pastry, and salad dressing, for frying croquettes, for table use, and for oiling machinery. Which is best for each purpose? Why?

## Questions:

1. What fats produce the best flavor and finest texture in cakes?
2. Which make the best pastry?
3. Which fat is most desirable for table use? Why?
4. What characteristics are desirable in salad dressings? How are they obtained?
5. What factors govern the selection of an oil for machinery?
6. What characteristics are desirable in fats used for deep fat frying? Why?

Subject Matter	Laboratory Experiments	References
I. Properties of fats and oils	I. Test different fats and oils by making cake and pastry.	Wellman, <i>Food Study</i> , 257-262, 285-287.
1. Fats are solid at ordinary temperature		
2. Oils are liquid at ordinary temperature	II. Test different fats and oils in	Forster & Weigley, <i>Foods &amp; San.</i> , 123-127

## (PROJECT 11—continued)

<p>3. Fats vary in melting points</p> <p>4. High heat causes smoking. Burning point varies. Acrolein produced.</p> <p>5. In presence of moisture fats become rancid, if exposed to air, or to warmth and light. Rancidity developed by oxidation and hydrolysis.</p> <p>II. Purposes for which fats and oils are used in cookery:</p> <ol style="list-style-type: none"> <li>1. For flavor</li> <li>2. For shortening</li> <li>3. For frying and sauteing</li> </ol> <p>III. Characteristics of good fats and oils</p> <ol style="list-style-type: none"> <li>1. For cookery             <ol style="list-style-type: none"> <li>a. For frying                 <ol style="list-style-type: none"> <li>1. High burning point</li> </ol> </li> <li>b. For baking                 <ol style="list-style-type: none"> <li>1. Good flavor</li> </ol> </li> <li>c. For mayonnaise                 <ol style="list-style-type: none"> <li>1. Good flavor</li> <li>2. Easily emulsified</li> </ol> </li> </ol> </li> <li>2. For table use             <ol style="list-style-type: none"> <li>a. Solid at ordinary temperature</li> <li>b. Good flavor</li> </ol> </li> <li>3. For lubrication             <ol style="list-style-type: none"> <li>a. Will not gum or oxidize</li> <li>b. Should be of thin consistency</li> <li>c. Must be non-volatile</li> <li>d. Should contain no acid or other injurious substances</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. mayonnaise,</li> <li>2. French dressing,</li> <li>3. cooked dressing.</li> </ol> <p>III. Find melting points of fats.</p> <p>IV. Find smoking points of fats and oils.</p> <p>V. Fry croquettes.</p>	<p>Fed. Bd. Bull. for Voc Ed. 35, <i>Use &amp; Prep. of Food</i>, 83-101.</p> <p>Brownlee <i>et al.</i>, <i>Chem. of Common Things</i>, 85.</p> <p>Greer, <i>Textbook of Cooking</i>, 76-85.</p> <p>Pattee, <i>Practical Dietetics</i>, 19-23.</p> <p>Van Rensselaer, Rose &amp; Canon, <i>Manual of Home-making</i>, 520-523.</p> <p>Univ. of Mo. Bull. 47, <i>Fats and Oils in Cookery</i>.</p> <p>Dowd &amp; Jamieson, <i>Food and Its Preparation</i>, 83-89</p> <p>Parloa, <i>Home Economics</i>, 292.</p>
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12. Project: How can I utilize the grease and fat which accumulate in our home?

Questions:

1. What ingredients are necessary? In what proportions?
2. What happens when a fat and an alkali are brought together?
3. What is the difference between soap made by the cold process and by the boiling process?

Subject Matter	Laboratory Experiments	References
I. Ingredients	I. Make soap by	Snell, <i>Ele. Household Chemistry</i> , 143-157.
1. Necessary ingredients	(1) the cold process,	
a. Fat	(2) the boiling process.	
b. Lye		Snyder, <i>Everyday Science with Projects</i> , 578-579.
2. Fillers		
a. Borax		Balderston, <i>Housewifery</i> , 136-139.
b. Salsoda, etc.		
II. Proportions		Van Buskirk & Smith, <i>Science of Everyday Life</i> , 301-302.
Use proportions found on can of lye		
III. Manipulation		Clark, <i>Introduction to Science</i> , 143-146.
Follow directions on can of lye		
IV. Precautions necessary		Dodd, <i>Chemistry of the Household</i> , 133-135.
1. In handling lye		Bailey, <i>Sanitary &amp; Applied Chemistry</i> , 128-136.
2. In kind of utensils used		
V. Molding		
VI. Cutting		
VII. Chemical reaction: "saponification"		Brownlee <i>et al.</i> , <i>Chem. of Common Things</i> , 302-306.
Fat + lye = soap + glycerine		

13. Project: What kind of water is best for us to drink? Why?

Questions:

1. What are the sources of drinking water?
2. From which source is the purest water obtained? Why?
3. How do cities make their water supplies safe for use?
4. What diseases are transmitted by drinking water?
5. How may water be contaminated?
6. If you suspect harmful bacteria in your drinking water, how can you make it safe for use?
7. Why is it better for a growing child to drink deep well water than to drink cistern water?

Subject Matter	Laboratory Experiments	References
I. Source of water	I. Compare the purity of your drinking water with boiled water, fresh rain water, and water from a river or lake.	Van Buskirk & Smith, <i>Science of Everyday Life</i> , 69-93.
1. Rain		
a. Cisterns		
2. Surface waters	II. Purify water by distillation.	Clark, <i>Intro. to Science</i> , 334, 346, 357-376.
a. Rivers		
b. Lakes & ponds		
c. Reservoirs		
3. Ground water	III. Make a filter with sand and gravel, and filter muddy water.	Smith & Jewett, <i>Intro. to Science</i> , 186-250
a. Wells	IV. Find out whether your drinking water contains minerals.	Brownlee <i>et al.</i> , <i>Chem. of Common Things</i> , 167-191
b. Springs	V. Find out whether your drinking water contains decaying vegetable matter.	Bailey, <i>Sanitary &amp; Applied Chem.</i> , 71-113.
II. Purification of water		
1. Methods		
a. Boiling		
b. Filtration		
c. Distillation		
d. Sedimentation		
e. Chemicals		Trafton, <i>Science of Home &amp; Community</i> , 45-57, 347-352.
III. Contamination of water	<i>Suggested Field Trip</i>	Snyder, <i>Everyday Science with Projects</i> , 196-208, 630-632.
1. Diseases transmitted by water	Visit your pumping station and water works, and learn about your city water supply.	Broadhurst, <i>Home &amp; Community Hygiene</i> , 92-114.
IV. Preventive measures to safeguard home water supplies		Tower & Lunt, <i>Science of Common Things</i> , 59-107.
1. In the country		Rosenau, <i>Preventive Medicine</i> , 789-986.
2. In the city		

14. Project: What are the best kinds of metals to use in the home, and how should they be cared for?

Questions:

1. What articles in the home are made of metal?
2. What kind of metal is best for each article?
3. If you were selecting a kettle for frying doughnuts, which metal would you select?
4. Why would you not cook meat in a copper or brass kettle?
5. How should I care for and clean the various metals?
6. If you burn food in an aluminum kettle, why would you not use a lye solution to clean it?

Subject Matter	Laboratory Experiments	References
I. Purposes for which metals are used in the home	I. Find in what kind of kettle water heats most quickly.	Clark, <i>Intro. to Science</i> , 173-180.
1. Kitchen equipment		Smith & Jewett, <i>Intro. to Study of Science</i> , 110, 408-410, 429-451.
a. Metals used		Balderston, <i>Housewifery</i> , 92-98.
1. Aluminum		Van Rensselaer, Rose & Canon, <i>Manual of Home-making</i> , 192, 225-239.
2. Enamel		Kinne & Cooley, <i>Foods &amp; Household Management</i> , 25-32, 357-358.
3. Iron		Parloa, <i>Home Economics</i> , 48-55, 353-357.
4. Tin		Forster & Weigley, <i>Foods &amp; Sanitation</i> , 25-30.
5. Copper		Wellman, <i>Food Study</i> , 120-122.
6. Brass		
7. Steel		
8. Nickel		
9. Bronze		
b. Properties of each	II. Clean various metals with different kinds of cleaners, and decide which is best to use and why.	
c. Advantages and disadvantages of each		
2. Table service		
a. Silver		
b. Steel		
3. Fixtures & trim		
II. Points to be considered in selecting metals		
1. Suitability for a particular purpose		
2. Method of care and preserving		
3. Methods of cleaning		
4. Wearing qualities		

15. Project: To launder my clothes.

Questions:

1. What kind of water is suitable for laundry purposes? Why?
2. How and when should stains be removed from clothes?
3. How can I prevent colored clothes from fading?
4. What kind of soap is best to use on different fabrics? Why?
5. What additional precautions are necessary in laundering silk and wool?

Why?

6. What kind of bluing should I use?
7. Why use starch? What kinds are best? Why? What fabrics should be starched?
8. What conditions are best for drying clothes?

Subject Matter	Laboratory Experiments	References
I. Water	I. Find out how much water softener, if any, is necessary to be added to your water in order to use the soap most economically, and determine which kind is cheapest.	Farmers Bull. No. 1099, <i>Home Laundering</i> .
1. Kinds		
a. Hard		Balderston, <i>Laundering</i> .
1. Temporary		
2. Permanent		
b. Soft		
2. Sources of water		Chambers, Mary D., <i>A Guide to Laundry Work</i> .
a. Deep wells		
b. Springs and streams		
c. Rain and snow		
3. Methods of softening water		Sheppard, Juanita, <i>Laundry Work</i> .
a. Boiling		
b. Use of softeners		
4. Advantages of making water soft		Van Rensselaer, Rose, & Canon, <i>Manual of Home-making</i> , 249-306.
a. Saves soap		
b. Fabrics look better		
c. Fabrics wear longer		
II. Removal of stains	II. Look over clothing for stains and remove any you find.	Bailey, <i>Sanitary &amp; Appl'd Chemistry</i> , 123-139.
1. Kinds of stains		
2. Method of removal		
a. Solution, e. g., blood, coffee, tea, fruit, grass		Farmers Bull. 861, <i>Removal of Stains</i> .
b. Absorption, e. g., grease, tar		
c. Bleaching, e. g. iron rust, scorch		
d. Neutralization, e. g., acids & alkalis		Van Buskirk & Smith, <i>Science of Everyday Life</i> , 302-305.
III. Setting of colors.	III. If new colored clothes are to be laundered	Kinne & Cooley, <i>Shelter &amp; Clothing</i> , p. 321.
Colors should be set before clothes are	set colors according to sug-	

## (PROJECT 15—continued)

laundered. Mordants to be used	gestions made in subject matter.	
1. Salt for blue, pink, purple, brown		<i>Laundrying at Home,</i> Amer. Washing Machine Manufacturers Association.
2. Vinegar for yel- and black		
3. Sugar of lead for green and lavender		
IV. Soap & soap substi- tutes	IV. Wash a woolen sweater or woolen under- wear for a baby.	
1. Kinds		
a. Strong		
b. Neutral		
2. Forms		
a. Bars		
b. Chips		
c. Flakes		
d. Washing powders		
V. Bluing		
1. Kinds		
a. Ultramarine		
b. Aniline		
c. Prussian blue		
VI. Starch		
1. Kinds & use		
a. Wheat: underwear		
b. Corn:col- lars, Cuffs, etc.		
c. Rice:lingerie		
d. Blended: collars, cuffs		
VII. Drying		

16. Project: How shall I remove the soiled spots from my woolen and silk clothing?

Questions:

1. What is the nature of the soiled spots?
2. What method shall I use to remove the spots?
3. When is dry cleaning preferable to laundering? Why?
4. How are grease spots removed by (1) gasoline, (2) blotting paper, (3) soap and water?

Subject Matter	Laboratory Experiments	References
I. Methods of remov- ing grease	I. Clean woolen and silk clothing.	Farmers Bull. U. S. D. A. No. 861, <i>Removal of Stains from Clothing and Textiles.</i>
1. Solution		
2. Absorption		

## (PROJECT 16—continued)

<p>3. Emulsification</p> <p>II. Agents which may be used</p> <p>1. Assolvents</p> <p>a. Gasoline</p> <p>b. Ether</p> <p>c. Chloroform</p> <p>d. Carbon tetra-chloride</p> <p>e. Naphtha</p> <p>f. Benzol</p> <p>g. Trade cleaners, as engine, carbona, etc.</p> <p>2. As absorbents</p> <p>a. Blotting-paper</p> <p>b. Fuller's earth</p> <p>c. Brown paper</p> <p>d. French chalk</p> <p>e. Powdered magnesia</p> <p>f. Starch</p> <p>3. As emulsifying agents</p> <p>a. Soap</p> <p>b. Mixture of "Turkey-red oil" and carbon tetra-chloride</p>	<p>II. Remove spots from rugs.</p>	<p>Van Buskirk &amp; Smith, <i>Science of Everyday Life</i>, 302-305.</p> <p>Snell, <i>Ele. Household Chemistry</i>, 158-161.</p> <p>Clark, <i>Intro. to Science</i>, 146-147.</p>
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17. Project: To dye material for a dress or for curtains for my bed room.

Questions:

1. What kind of dye shall I use?
2. How shall I prepare my material for the dye bath?
3. What is the purpose of a mordant?

Subject Matter	Laboratory Experiments	References
<p>I. Dyes</p> <p>1. Classification according to properties</p> <p>a. Direct</p> <p>b. Indirect</p> <p>II. Kinds of dyes on market</p> <p>1. Cold water dyes</p>	<p>I. Dye your material, following directions given on package.</p>	<p>Brownlee <i>et al.</i>, <i>Chemistry of Common Things</i>, 336-343.</p> <p>Clark, <i>Introduction to Science</i>, 138-139, 168-172.</p> <p>Woolman, <i>Clothing, Choice, Care &amp; Cost</i>, 199-215.</p>

## (PROJECT 17—continued)

a. Rit b. Butterfly tints c. Angel Dainty etc. 2. Hot water dyes a. Putnam's b. Diamond		Woolman & McGowan, <i>Textiles</i> , 317-333.  Kinne & Cooley, <i>Shelter &amp; Clothing</i> , 160-161. Snell, <i>Ele. Household Chemistry</i> , 254-266.
III. Mordants		
1. Kinds		
2. Purposes.		
IV. Procedure		
Follow directions on package of dye		
V. Precautions necessary		

18. Project: When buying clothing and house furnishings, how can I tell whether the materials are pure wool, pure silk, pure linen, or a combination of two or more of these fibers?

## Questions:

1. What are the characteristics of the different fibers?
2. What tests should I apply to detect the presence of the various fibers?

Subject Matter	Laboratory Experiments	References
I. Characteristics of fibers as shown by tests 1. Appearance under microscope 2. Effect of burning 3. Effect of chemicals 4. Feel of materials 5. Tearing 6. Effects of oil, glycerine, water	Apply the following tests to samples of materials: 1. Microscopic, 2. Burning, 3. Chemical, 4. Feeling, 5. Tearing, 6. Oil, glycerine, water (for linen).	Woolman & McGowan, <i>Textiles</i> , 265-316. Snell, <i>Elementary Household Chemistry</i> , 222-236.  Kinne & Cooley, <i>Shelter and Clothing</i> , 194-199.  Baldt, <i>Clothing for Women</i> , 31-32. Dooley, <i>Textiles</i> , 267-318 Balderston, <i>Housewifery</i> , 176. Van Rensselaer, Rose & Canon, <i>Manual of Home-making</i> , 326-329.

19. Project: What must I know about fabrics in order that I may select them wisely for my clothing and household furnishings?

Questions:

1. What kind of fabrics are suitable for my (1) underwear, (2) outer clothing, (3) coat, (4) hose, in winter? In summer?
2. Which color is most suitable for wear at different times of the year? Why?
3. Which kind of clothing is safer if soaked with water, woolen or cotton? Why?
4. Why do men who fire furnaces wear woolen shirts in the summer?
5. For a cold, windy day which would be warmer, two wool sweaters or a sweater and a canvas coat?
6. Why are flannel undergarments used on small babies?

Subject Matter	Laboratory Experiments	References
I. Factors to be considered in selecting materials	I. Conduction Find by experiment which fabric is the best conductor of heat, and which is the poorest.	Van Buskirk & Smith, <i>Sci. of Everyday Life</i> , 286-306
1. Conduction of heat by		Smith & Jewett, <i>Intro. to Study of Science</i> , 95-96.
(a) Wool		
(b) Silk	II. Heat absorption by colors	Clark, <i>Intro. to Science</i> , 129-137.
(c) Cotton	Find which color absorbs the greatest amount of heat and which absorbs the smallest amount of heat.	Dooley, <i>Textiles</i> , 267-318
(d) Linen		Woolman & McGowan, <i>Textiles</i> , 346-355
2. Absorption of heat by different colors	III. Resistance to water. Find which fabric is the least resistant and which is the most resistant to water.	Balderston, <i>Housewifery</i> , 176-184
3. Hygroscopicity of different fibers		Kinne & Cooley, <i>Shelter &amp; Clothing</i> , 188-199.
4. Resistance to water	IV. Test different materials for	Van Rensselaer, Rose & Canon, <i>Man. of Homemaking</i> , 307-329.
5. Fastness of color	(1) shrinkage,	Sch. Sci. & Math. Vol. 22, No. 5, May, 1922.
a. To sun	(2) dressing,	
b. To water	(3) fastness of color.	
6. Shrinkage	V. Test different weaves of cloth for absorptive and conductive properties.	
7. Dressing		
8. Weave		



20. Project: To learn to weigh and measure the materials which we use to prepare food, clothing, and shelter.

Questions:

1. What weighing and measuring devices do I need in order to weigh and measure the materials which I use in my home?
2. When and where are the different systems of weights and measures used?

Subject Matter	Laboratory Experiments	References
I. Systems of weights and measures	I. The proportions for 1 c. cocoa are as follows: 1 t. cocoa, 2 t. sugar, 2 t. water $\frac{7}{8}$ c. milk.	Bureau of Standards, Circ. 55, <i>Measurements for the Household</i> .
1. Kinds		
a. English		Taber, <i>Business of the Household</i> , 227-233.
b. Metric		
2. Use of each	Measure out ingredients to make 6 c. of cocoa. Weigh ingredients necessary for this amount. Arrange weights and measures in a table. If the French people were measuring this amount, they would use cc. and liters. How many cc. in 1 c.? In 1 qt?	Van Rensselaer, Rose & Canon, <i>Man. of Homemaking</i> , 129-131.
II. Units of weights and measures		
1. Standard units		Lynde, <i>Physics of the Household</i> , 24-29, 304-307.
2. Fundamental units		
a. Length		
b. Mass		
c. Time		
3. Derived units		Pattee, <i>Practical Dietetics</i> , 98-106.
a. Area		
b. Volume		
c. Velocity		
III. Method of calculating volume of containers used in the household	II. Find out how many potatoes (a) a given rectangular box will hold (b) a given cylindrical container. Weigh this amount of potatoes. What part of a bushel is this amount?	Butler, <i>Household Physics</i> , 2-5.
	III. Find out how much material will be required to make curtains for your room. Make out a table for linear measure.	Pirie, <i>Science of Homemaking</i> , 61-63.
1. Of a square or rectangular box:		Balderston, <i>Housewifery</i> , 145-147.
$\frac{L \times W \times H \text{ (in inches)}}{2150.4} = \text{bu.}$	IV. Find out how much material it will take to cover your kitchen floor at home.	
2. Of a cylindrical box:	V. Find out by weighing how many ounces and how many grams in 1 c. sugar. How many grams in 1 oz. sugar? In 1 lb.?	
$\frac{\pi \times R^2 \times H}{2150.4} = \text{bu.}$		

21. Project: To learn what factors influence the boiling point of a liquid.

Questions:

1. What is meant by the term "boiling point"?
2. What is the effect of a dissolved substance on the boiling point of a liquid?
3. Why is it hard to cook some foods on the top of high mountains?
4. Where would beans cook more quickly, on top of Pike's Peak or at sea level? Why?
5. Why does food cook more quickly in a pressure cooker than in an ordinary kettle?
6. What is the boiling point of water on the Fahrenheit scale? On the centigrade scale?
7. The best temperature for baking muffins is 225°C. What would the temperature be if you used a Fahrenheit thermometer?
8. The fat for cooking French fried potatoes should be 375°F. What would this temperature be on a centigrade thermometer?
9. Would there be any difference between the boiling point of prunes when they first begin to boil and when they are done?

Subject Matter	Laboratory Experiments	References
I. Boiling point of liquid raised by	I. Test boiling point of water.	Brechner, <i>Household Physics</i> , 3-10.
1. Increasing its density		
2. Increasing the pressure.	II. Find effect on boiling point of water of	Butler, <i>Household Physics</i> , 34-38.
II. Boiling point lowered by	(1) a dissolved substance,	Clark, <i>Introduction to Science</i> , 18-20, 37-38.
1. Decreasing pressure.	(2) a suspended substance.	
III. Thermometers	III. Find by experiment the effect on the boiling point of	Lynde, <i>Physics of the Household</i> , 148-150.
1. Kinds	(1) Increased pressure,	
a. Fahrenheit	(2) Decreased pressure.	Trafton, <i>Science of Home &amp; Community</i> , 23, 510-511.
b. Centigrade		
2. Use of each kind	IV. Heat water in a pressure cooker.	Smith & Jewett, <i>Intro. to the Study of Science</i> , 299-304.
	V. Learn to change from centigrade to Fahrenheit readings, and vice versa.	Van Buskirk & Smith, <i>Science of Everyday Life</i> , 90-91.
		Univ. of Mo. Circ. 96, <i>Steam Pressure Cooking</i> .

22. Project: What kind of fuel is best to use in my home? Why?

Questions:

1. Why do some fuels burn more readily than others?
2. Why do we use paper and wood to kindle fires?
3. What is the difference between hard and soft coal?
4. Why are oils and gases more dangerous to use than wood and coal?

Subject Matter	Laboratory Experiments	References
I. Types of fuels		Keene, <i>Mechanics of the Household</i> , 182-195, 250-304.
1. Solid		Clark, <i>Introduction to Science</i> , 118-128.
a. Wood		Snell, <i>Ele. Household Chem.</i> 59-71.
b. Coal		Lynde, <i>Physics of the Household</i> , 152-154.
1. Anthracite		
2. Bituminous		
3. Peat		
4. Coke		
2. Liquid		
a. Gasoline		
b. Kerosene		
c. Alcohol		
3. Gaseous	I. Make acetylene in laboratory.	Smith & Jewett, <i>Intro. to Study of Science</i> , 58-59, 128, 141-145.
a. Coal gas		
b. Natural gas		
c. Acetylene		
d. Blau gas		
4. Electricity		Van Buskirk & Smith, <i>Science of Everyday Life</i> , 270-276, 283-284.
II. Properties of each type of fuels		Brownlee et al., <i>Chem. of Common Things</i> , 101-113.
1. Kindling point		Brechner, <i>Household Physics</i> , 60-64.
2. Flashing point		Balderston, <i>Housewifery</i> , 53-56, 206.
III. Combustion		
IV. Relative value of types of fuel as source of heat		

23. Project: What system of heating should we use in the new house we are building?

Questions:

1. How does a fireplace warm a room?
2. How does a stove warm a room?
3. Why do fireplaces and stoves sometimes smoke?
4. How does each type of furnace heat a house?
5. How is the water in a hot water tank heated?

Subject Matter	Labortaory Experiments	References
I. Methods of Heating	I. Set up an experiment to demonstrate a draft.	Lynde, <i>Physics of the Household</i> , 90-98.
1. Open fire		
a. Fire-place		
1. Principles of construction	II. Set up experiments to show:	Smith & Jewett, <i>Intro. to Study of Science</i> , 58-69, 93-111
2. Principles of heating	1. How a hot air furnace heats a house,	
2. Stoves	2. How a steam heating system heats a house,	Clark, <i>Intro. to Science</i> , 13-32.
a. Kinds	3. How a hot water system heats a house,	
1. Heating	4. How the water in a hot water tank is heated.	Trafton, <i>Science of Home &amp; Community</i> , 3-16.
2. Cooking		
b. Principles of construction		Van Buskirk & Smith, <i>Science of Everyday Life</i> , 270-285.
c. Principles of heating		
3. Furnaces		
a. Hot air		Brechner, <i>Household Physics</i> , 47-59.
1. Piped		
2. Pipeless		
b. Steam		
c. Hot water		Butler, <i>Household Physics</i> 52-74.
d. Principles of construction of each type of furnace	<i>Suggested Field Trip</i>	
e. Principles of heating in each type	Visit homes having the various heating systems.	Keene, <i>Mech. of the Household</i> , 1-81.
II. Ventilation provided by each method of heating		Bailey, <i>San. &amp; Appl'd Chem.</i> , 39-53.
III. Effect of each method of heating on humidity		Balderston, <i>Housewifery</i> , 52-83.
IV. Advantages and disadvantages of each type		Van Rensselaer, Rose & Canon, <i>Man. of Home-making</i> , 191-196, 207-214.
V. Comparison		

24. Project: Is our house well ventilated? If not, what must we do in order that the ventilation will be good?

Questions:

1. Why is ventilation necessary?
2. What are the ill effects of improper ventilation?
3. What should be the condition of the air we breathe?
4. How can we help to get the air we breathe into proper condition?
5. How many cubic feet of air space per person is desirable?
6. Why is a special ventilation system required for churches, theatres, etc?

Subject Matter	Laboratory Experiments	References
<p>I. Why ventilation is necessary</p> <ol style="list-style-type: none"> <li>1. Oxygen used up by breathing</li> <li>2. Poisonous gas given off</li> <li>3. Air becomes too moist</li> <li>4. Disease germs collect</li> </ol> <p>II. Conditions maintained by proper ventilation</p> <ol style="list-style-type: none"> <li>1. Good circulation of air</li> <li>2. Proper humidity</li> <li>3. Correct temperature</li> </ol> <p>III. Methods of ventilation</p> <ol style="list-style-type: none"> <li>1. Circulation of air by               <ol style="list-style-type: none"> <li>a. Windows</li> <li>b. Chimneys</li> <li>c. Fans</li> <li>d. Hot air furnaces</li> <li>e. Ventilators in walls</li> <li>f. Open grate</li> </ol> </li> <li>2. Moisture from               <ol style="list-style-type: none"> <li>a. Watering plants</li> <li>b. Water box on hot air furnace</li> <li>c. Pans of water</li> </ol> </li> <li>3. Temperature (65°-70°) by               <ol style="list-style-type: none"> <li>a. Fans (summer)</li> <li>b. Stoves</li> <li>c. Furnaces</li> <li>d. Windows and shades</li> </ol> </li> </ol>	<p>I. Prove that carbon dioxide gas is exhaled.</p> <p>11. Raise window at bottom. Lower at top. By means of lighted candle find where fresh air comes in and where foul air goes out.</p> <p>III. Repeat II at top and bottom of a door partly opened between a warm and a cold room.</p> <p>IV. Find where the air is cooler, at the top or at the bottom of a room.</p> <p>V. Find the percentage of humidity in the air.</p> <p>VI. Show circulation of air by means of a ventilation box.</p> <p>VII By measuring find out whether the window space in your room at home admits enough fresh air.</p>	<p>Lynde, <i>Physics of the Household</i>, 111-114.</p> <p>Bailey, <i>San. &amp; Appl'd Chem.</i>, 45-53.</p> <p>Trafton, <i>Science of Home &amp; Community</i>, 4-7, 17-32.</p> <p>Clark, <i>Introduction to Science</i>, 27, 44, 58-59.</p> <p>Richards &amp; Woodman, <i>Air, Water, &amp; Food</i>, 19-56.</p> <p>Van Buskirk &amp; Smith, <i>Science of Everyday Life</i>, 50-56.</p> <p>Keene, <i>Mechanics of the Household</i>, 219-249.</p> <p>Snyder, <i>Everyday Science with Projects</i>, 112-114.</p> <p>Gruenberg, <i>Ele. Biology</i>, 154-173.</p> <p>Brechner, <i>Household Physics</i>, 54-57.</p> <p>Broadhurst, <i>Home &amp; Community Hygiene</i>, 115-148, 228-233.</p> <p>Smith &amp; Jewett, <i>Intro. to Study of Science</i> 102-103.</p>

25. Project: What system of lighting is best to use in my home?

Questions:

1. Why may a candle be called a "gas factory"?
2. What is the purpose of each part of a lamp?
3. Why are mantles used with gas lights?
4. What produces a light in an electric bulb?
5. In lighting your home which of the methods given in experiment V are used?
6. Which room needs more artificial light, one with dark walls or one with light walls?

Subject Matter	Laboratory Experiments	References
I. Methods of artificial lighting	I. Observe burning candle.	Brownlee <i>et al.</i> , <i>Chem. of Common Things</i> , 132-143.
1. Candles		
2. Lamps		Van Buskirk & Smith, <i>Sci. of Everyday Life</i> , 248-270.
3. Gas	II. Observe burning lamp.	
a. Natural		
b. Manufactured	III. Observe gas burning.	Clark, <i>Introduction to Science</i> , 275-280.
1. Coal gas		
2. Acetylene		
3. Gasoline		
4. Blau gas	IV. Observe lighted electric bulb.	Trafton, <i>Science of Home &amp; Community</i> , 33-44.
4. Electricity		
II. Principles involved in lighting	V. Work out experiments to show reflection, diffusion and transmission of light.	Tower & Lunt, <i>Science of Common Things</i> , 223-258.
1. Candle: Solid fat changed by heat to liquid which is transferred through wick by capillarity, and changed by heat to gas which burns.		Millikan & Gale, <i>A First Course in Physics</i> , 351-356.
2. Lamp : Oil conveyed by capillarity through wick. Vapor burns.		
3. Electricity : Resistance offered produces heat and light.		
III. Properties of liquids which make them suitable for lighting purposes.		
IV. Kinds of electric lamps		
1. Carbon		
2. Gem		
3. Tungsten		

### The Method Suggested for Carrying out a Project

1. The pupils, with the advice of the teacher, should select the project.
2. The pupil should do the following:
  - a. Plan what is to be done.
  - b. Read books and magazine articles helpful in solving the problems involved.
  - c. Make a list of the references, stating the name of the authors, the books, bulletins, or magazine articles, and the pages to be read in each.
  - d. Collect information and obtain all supplies needed.
  - e. Make experiments where necessary to solve problems.
  - f. Organize the information gathered.
  - g. Summarize what has been learned.
3. The group, then, should discuss the summary and apply to other problems the information gained.

### Sample Lesson I

At the beginning of the course, the pupil was given a list of references and of questions pertaining to the project, as indicated in the following lesson. Later in the course very little written help was given.

Project: To make an iceless refrigerator. (cf. p. 8.)

#### A. References:

Snyder, *Everyday Science with Projects*, 591-593.

Van Buskirk & Smith, *Science of Everyday Life*, 93.

Clark, *Introduction to Science*, 41-43.

Butler, *Household Physics*, 33-34.

Frederick, *Household Engineering*, 54-55, 478-479.

#### B. Questions:

1. How does the principle of the iceless refrigerator differ from or compare with that of the iced refrigerator?
2. Will an iceless refrigerator work better when the air is full of moisture, or when the air is dry? Why?
3. Where should an iceless refrigerator be placed? Why?
4. Why does sprinkling a lawn or street on a hot day cool the air?
5. Why is the air cooler after a rain than before?
6. Why is a wet flower pot cooler than a dry one?
7. Why should damp clothing never be worn?
8. Why does alcohol feel colder on one's hand than water?
9. If equal amounts of water are placed in a saucer and in a bottle, which will evaporate more quickly? Why?
10. If the same amounts of food and water are placed in a wide flat pan and in a deep narrow pan, which will cook dry first? Why?
11. Why do clothes dry better on a clear, windy day than on a clear, calm day?
12. Do all liquids evaporate at the same rate?
13. What are the factors which affect evaporation?

**Pupil's Report (Early in year)**

Name of pupil.....Date.....

Project: To make an iceless refrigerator.

Time devoted to the project: 6 hours.

## References:

- Snyder, *Everyday Science with Projects*, 591-593.  
Van Buskirk & Smith, *Science of Everyday Life*, 93.  
Clark, *Introduction to Science*, 41-43.  
Butler, *Household Physics*, 33-34.  
Frederick, *Household Engineering*, 54-55, 478-479.

## Results:

1. In an iceless refrigerator, food is cooled by evaporation of water. Evaporation of moisture cools surrounding objects. In an iced refrigerator, food is cooled by air which circulates over and around ice.
2. An iceless refrigerator works better when the air is dry than when it is moist, because evaporation takes place more rapidly when the air is dry than when it contains moisture.
3. An iceless refrigerator should be put in a dry place, and in a draft, if possible, so that the water will evaporate rapidly.
4. Evaporation of moisture after sprinkling a street or lawn makes the air cooler.
5. After a rain the evaporation of moisture takes heat from surrounding objects.
6. A wet flower pot is cooler than a dry one, because as the moisture evaporates, it takes heat from the pot.
7. Damp clothing takes heat from the body as it dries, lowering the body temperature too rapidly.
8. Alcohol feels colder to the hand than water because alcohol evaporates more rapidly.
9. Water will evaporate more quickly in a saucer than in a bottle, because in a saucer a greater amount of the surface of the water is exposed to the air.
10. Food will cook dry in a flat pan more quickly than in a deep pan on account of the greater amount of the surface of the food exposed to the heat.
11. Clothes dry more quickly on a windy day, because the breeze carries away the moisture as it evaporates, leaving drier air next to the clothes.
12. Some liquids evaporate more quickly than others.
13. Factors which affect evaporation are
  - (a) nature of the liquid,
  - (b) amount of surface exposed,
  - (c) condition of the surrounding atmosphere.



## Sample Lesson II

Project: To learn how candles and lamps give light.

The statement of the project above was the only written help given to the pupil. She selected and read references, performed the experiments, and made out questions as follows:

## A. References:

- Snell, *Elementary Household Chemistry*, 75-77.  
Lynde, *Physics of the Household*, 248.  
Trafton, *Science of the Home and Community*, 33-38.  
Bailey, *Sanitary and Applied Chemistry*, 56-58, 67-68.  
Balderston, *Housewifery*, 80-81.  
Clark, *Introduction to Science*, 240-243, 275-277.  
Van Rensselaer, Rose, & Canon, *Manual of Homemaking*, 200.  
Dodd, *Chemistry of the Household*, 92-96.  
Brownlee *et al.*, *Chemistry of Common Things*, 132-133.

## B. Experiments:

1. Examine parts of a candle flame.  
Dodd, *Chemistry of the Household*, 93.  
Trafton, *Science of Home and Community*, 35.
2. Find conditions needed for a candle to continue burning, and find products given off by a burning candle.  
Trafton, *Science of Home and Community*, 35-36.
3. Study structure and workings of a kerosene lamp.  
Trafton, *Science of Home and Community*, 37-38.

## C. Questions:

1. What were the steps in the development of artificial lighting before the time when lamps appeared?
2. Of what are candles made? How are they made?
3. How does the process used to make candles at the present time compare with that used in early times?
4. What is the purpose of the wick?
5. What uses are made of candles at the present time?
6. What is meant by "candle power"?
7. Describe the ancient Greek and Roman lamps.
8. What was burned in the earliest lamps?
9. Who invented lamps with burners? When?
10. What is the purpose of each part of the lamp?
11. Why does a lamp have a chimney whereas a candle does not?
12. Why may a candle be called a "gas factory"?
13. What is given off when a candle or a lamp is burning?
14. Why does a lamp sometimes smoke?
15. What causes explosions in lamps?
16. What is the source of kerosene?
17. What is the purpose of reflectors? Of mantles?
18. How are mantles made?
19. How does a Rochester lamp differ from an ordinary lamp?

20. What are the advantages and disadvantages respectively of candles and lamps?
21. Compare candles and lamps with other methods of artificial lighting in:
  - (a) cost,
  - (b) amount of light given,
  - (c) kind of light,
  - (d) healthfulness,
  - (e) care required,
  - (f) availability,
  - (g) danger.

### Pupil's Report (Middle of year)

Name of pupil.....

Date.....

Project: To learn how candles and lamps give light.

Time devoted to the project: 5 hours.

#### References:

- Trafton, *Science of Home and Community*, 33-38.  
Bailey, *Sanitary and Applied Chemistry*, 56-58, 67-68.  
Balderston, *Housewifery*, 80-81.  
Brownlee *et al.*, *Chemistry of Common Things*, 132-133.  
Lynde, *Physics of the Household*, 248.  
Clark, *Introduction to Science*, 240-243, 275-277.  
Snell, *Elementary Household Chemistry*, 75-77.  
Dodd, *Chemistry of the Household*, 92-96.  
Van Rensselaer, Rose & Canon, *Manual of Homemaking*, 200.

#### Results:

The first methods of artificial lighting were by fires made out in the open. Next torches were used. Then came very crude lamps. These were hollowed-out rocks, sea-shells, or animal skulls. Animal and vegetable oils were burned in these. The kerosene lamps were introduced by a Swiss chemist, Argand, in 1853. The bowl holds the oil. The burner holds the wick, regulates the height of the flame, and the amount of air admitted. The chimney helps to make an even light by promoting an even upward draft of air. This keeps the flame from flickering. Mantles are used to give brighter light. In early times candles were made by two methods, dipping and pouring. The purpose of the wick is to draw up the melted fat. The heat converts the fat into a vapor, which burns with a flame.

Candles and lamps must have oxygen to burn, and they give off carbon dioxide.

Kerosene is obtained from crude oil by a process called distillation.

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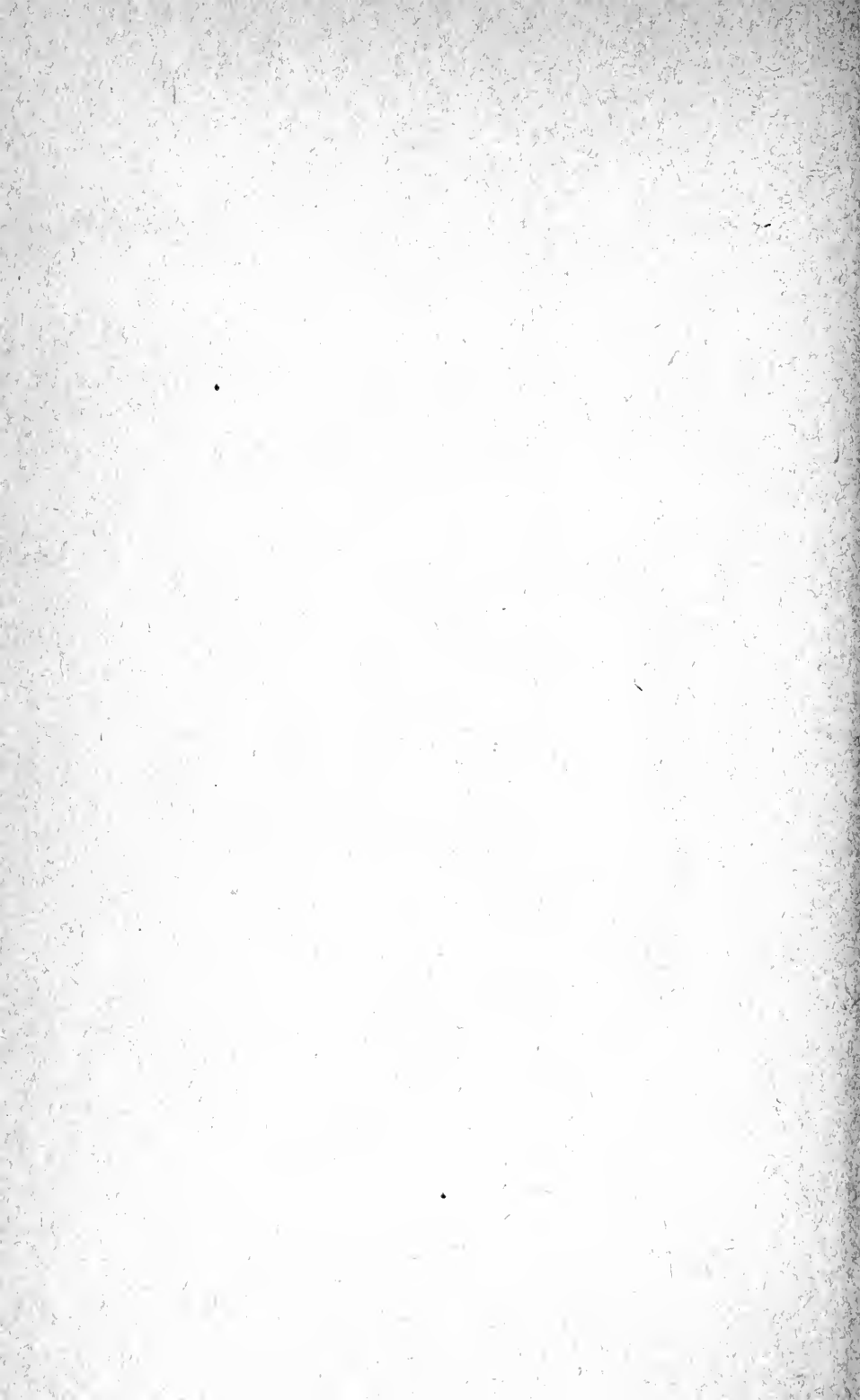
# A School Building Program for Columbia, Missouri

By

M. G. NEALE

*Dean of the Faculty of the  
School of Education, University of Missouri*





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January 12, 1925.

Board of Education and Superintendent of Schools,  
Columbia, Missouri.

Gentlemen:

I am handing you herewith my report on a school building program for the city of Columbia which I have made in response to your invitation.

I regard this as a particularly interesting time to study the school building situation in Columbia because all the indications seem to be that Columbia is likely to have an exceptionally rapid growth in population during the next two decades with a consequent rapid increase in the number of children attending all grades in school. Because of this fact, I consider it exceptionally fortunate that the board is giving special consideration at this time to the planning of a school building program which will include all the necessary provisions for the highest type of public school education.

I desire to take this occasion to express my appreciation of the cordial spirit in which assistance has been given by all those connected with the Columbia public schools in the collection of the facts used in this report. I wish also to express my appreciation of the very pleasant preliminary conferences that I have had with the Board of Education while the report was in process of preparation.

Acknowledgment is hereby made of the assistance of more than fifty students of City School Administration during the Summer Session of 1924 in the collection and tabulation of much of the data used in this report. Special mention should be made of the help given by Mr. J. W. Diefendorf, Assistant in Educational Administration, University of Missouri; Clyde M. Stephens and J. L. Vincent, graduate students in the School of Education. These men assisted in rescoring the school buildings and furnished valuable suggestions in connection with the recommendations made in this report. Grateful acknowledgment is also made of the suggestions given by my colleagues in the School of Education.

Very truly yours,

M. G. Neale,

Dean of the Faculty of the  
School of Education,  
University of Missouri.

## CHAPTER I.

### THE SCHOOL BUILDING SITUATION IN COLUMBIA.

#### Buildings and Enrollment

During the school year 1923-24 a total of 2,694 pupils were enrolled in the public schools of Columbia. Of these 2,189 were white pupils and 505 colored. Of the white pupils, 709 or 34 per cent were enrolled in high school (grades 9, 10, 11, and 12), 161 or 7 per cent in grade seven and the remaining 1,319 in grades 1 to 6.

The high school pupils were housed in the high school building on North Eighth street between Rogers and Hickman avenues; the 161 seventh grade pupils in the old Jefferson elementary school building on Rogers Avenue between Seventh and Eighth streets. The thirteen hundred and odd pupils enrolled in grades 1 to 6 were housed in five elementary school buildings with the following total enrollment for the year.

Benton.....	286
Field.....	266
Grant.....	223
Lee.....	242
Ridgeway.....	302
<hr/>	
Total.....	1,319

The 505 colored pupils are all housed in the Fred Douglas school, 385 in grades 1 to 7 and 120 in the high school department (grades 9, 10, 11, and 12).

As a whole the school buildings of Columbia were constructed fairly recently as the ages of school buildings go. The dates of erection as shown by the records in the superintendent's office are:

Jefferson.....	1899
Benton.....	1896—1914
Lee.....	1904—1916
High School.....	1910
Grant.....	1910
Field.....	1916
Douglas.....	1917
Ridgeway.....	1923

Although constructed in comparatively recent years the school plant of Columbia is not an expensive one as the following figures on the total cost of all buildings tend to show:

Building	Approximate Cost of Building
Jefferson.....	\$ 18,000
Benton.....	17,500
Lee.....	17,600
Grant.....	20,000
Field.....	30,000
Douglas.....	36,000
Ridgeway.....	47,500
High School.....	105,000

As might be expected from the cost figures just quoted, Columbia does not have what might be called a high class set of school buildings. None of them is extremely poor; none is exceptionally high class. This is not a criticism of the quality of construction because for the money invested most of them are exceptionally well built. A careful examination shows that they were constructed at too small a cost to make possible the provisions that first class school buildings should include.

### A Rating of the Buildings

In order to have some definite basis for passing judgment on the character of the school buildings of Columbia they were rated by means of a standardized card for judging city school buildings. The score card used was designed by experts in city school administration working in conjunction with school architects. It has been used in scoring thousands of school buildings in all parts of the United States and has been very satisfactorily standardized. The score card, which is reproduced in the appendix, consists of 107 separate items on which a school building may be judged. Each item has a standard value which a perfectly satisfactory building should obtain. In order to secure a fair judgment each building in Columbia was scored by three persons and the final score for each building was determined by taking the median score of the three scorers on the major divisions of the score card. In Table I is an illustration of how the final score for the Ridgeway school was obtained.

The high school building was scored by means of a special form of the score card devised and standardized for secondary school buildings. A sample of this score card is reproduced in the appendix.

A building first class in every particular should score 1000 points. A building scoring from 800 to 1000 may be considered as highly satisfactory. A building scoring between 600 and 800 points may be a good building but is ordinarily lacking in many essential features common to modern school buildings. Buildings scoring between 500 and 600 are usually lacking in the essential features that characterize modern

school buildings and are commonly in need of extensive additions or general rehabilitation. A score falling between 400 and 500 usually means a building that is not good enough to warrant any extensive program of modernization and one that should be included in a replacement program for the near future. Buildings scoring below 400 are usually not suited for modern school purposes and should commonly be scheduled for immediate replacement.

TABLE I  
SUMMARY OF SCORES  
RIDGEWAY BUILDING

Scorer's No.	1	2	3	Median	Total
Item I.....					90
A.....	40	45	45	45	
B.....	25	25	27	25	
C.....	20	25	10	20	
Item II.....					113
A.....	13	13	15	13	
B.....	55	47	53	47	
C.....	55	49	53	53	
Item III.....					151
A.....	67	62	75	67	
B.....	20	18	19	19	
C.....	10	14	11	11	
D.....	11	11	14	11	
E.....	4	5	3	4	
F.....	10	9	9	9	
G.....	30	30	23	30	
H.....					
Item IV.....					223
A.....	30	30	30	30	
B.....	69	66	74	69	
C.....	77	75	74	75	
D.....	22	20	20	20	
E.....	25	42	29	29	
Item V.....					43
A.....	18	16	17	17	
B.....	5	5	5	5	
C.....	17	24	21	21	
Total.....	628	631	627	628	620

With these facts in mind the scores of the buildings as shown in Chart I may be interpreted. According to these scores Columbia has one building that should be immediately abandoned for school purposes and two that should be slated for replacement in the near future. Attention has been called to the fact that none of the school buildings of Columbia rank as first class when judged on the basis of the standards which should characterize modern school buildings. The interested

citizens may well inquire why this is so. Such an inquiry may best be answered by presenting an analysis of the scores of various buildings as shown in Table II and III. These tables show that aside from Lee, Benton and Jefferson the greatest deficiencies are in the item headed service systems and special rooms.

## CHART 1

SCORES OF ELEMENTARY SCHOOL BUILDINGS OF  
COLUMBIA COMPARED WITH STANDARD SCORE.

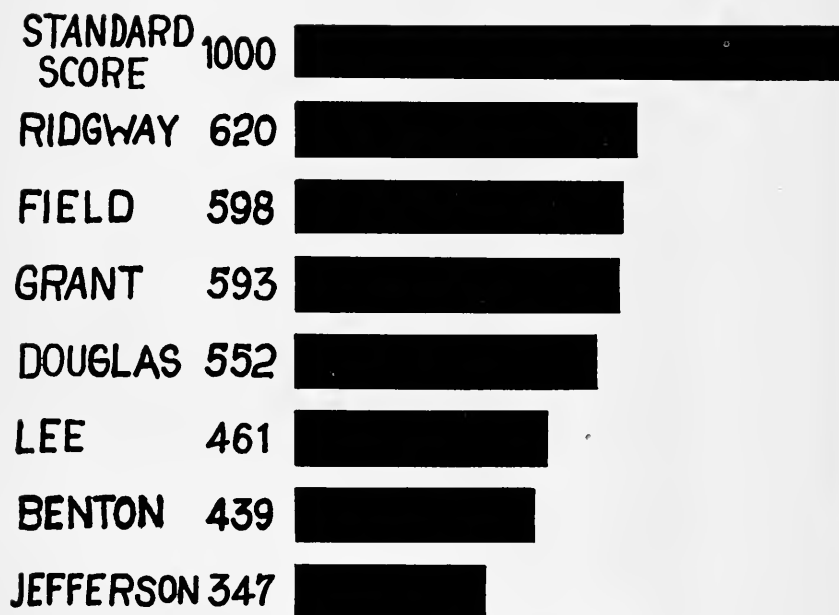


TABLE II

ANALYSIS OF COLUMBIA SCHOOL BUILDING SCORES ACCORDING  
TO MAJOR ITEMS.

Item	Stand- ard	Ridge- way	Field	Grant	Doug- las	Lee	Ben- ton	Jeffer- son	Aver- age
Site .....	125	90	79	105	91	73	90	88	73.7
Building .....	165	113	121	106	113	83	75	56	95.3
Service System.....	280	151	154	143	139	94	95	81	124.0
Classrooms.....	290	223	215	216	173	191	157	111	184.0
Special Rooms.....	140	43	29	23	36	20	22	11	26.3
Total.....	1000	620	598	593	552	461	439	347	515.7

TABLE III

PER CENT OF STANDARD SCORE MADE BY EACH BUILDING ON  
MAJOR DIVISIONS OF THE SCORE CARD

Item	Ridge- way	Field	Grant	Doug- las	Lee	Benton	Jeffer- son	Aver- age
Site.....	72	68	84	72	58	72	70	59.0
Building.....	68	73	64	68	50	45	33	57.7
Service System.....	53	55	51	49	33	33	28	44.3
Classrooms.....	76	74	74	59	65	56	38	63.4
Special Rooms.....	30	20	16	25	14	15	7.8	18.8
All Items.....	62.0	59.8	59.3	55.2	46.1	43.9	34.7	51.57

### Little Provision for Special Rooms

The elementary school buildings scored lowest on the item of special rooms. This is because no adequate provisions has been made in any of them for the special features that have been commonly supplied in connection with elementary school buildings constructed during the past ten or fifteen years. For a modern elementary school of the size which will likely be reached in the near future by the elementary schools of Columbia, there should certainly be a combined gymnasium and auditorium to provide adequate facilities for indoor play and physical exercises, and which would also on proper occasions provide an assembly room for the school and for the patrons of the community for any community gatherings that might profitably be held. For an elementary school such a combined auditorium and gymnasium should be at least 40 by 60 feet. It should have a stage and should be equipped with movable chairs.

In addition to a combined auditorium and gymnasium for indoor play, school assemblies, and community meetings, modern elementary schools should have a special library room well equipped with general reference books and reading material adapted to the interests of pupils in the first six grades. In some cities branches of the public library have been established in elementary schools. The writer has seen such rooms being used by a large number of boys and girls not only during the regular school term but during the summer months. Where such branch libraries are established, books and magazines for adults are also commonly provided. In connection with the gymnasium-auditorium there should be adequate shower bath facilities for both boys and girls. For an elementary school to house six hundred children, a swimming pool would obviously be too expensive an item to be thought of seriously, but adequate shower facilities are considered an indispensable feature of a modern elementary school. In an elementary school building planned to ultimately house six hundred elementary school pupils a

lunch room should be provided for those children who live so far away that they are not able to go home for lunch. No expensively equipped household arts or industrial arts rooms are needed in connection with an elementary school building housing the first six grades. The survey committee, however, does believe that there should be one room available in every elementary school building for such household art work as teachers may wish to undertake in connection with their regular class room instruction. Such a room when provided in connection with a lunch room would ordinarily not be an unduly large item of expense. There should also be one industrial arts room where pupils may undertake special manual arts activities that need to be taken in connection with regular class room work. Such rooms would be in the nature of activity rooms. This policy has apparently been adopted by the board in placing a household arts and industrial arts room in the newer elementary school buildings.

An adequate principal's suite should be provided in connection with every elementary school building. This is a feature that is now practically lacking in Columbia school buildings. Such a suite should be located on the first floor near the main entrance, and for buildings of the size of those recommended for Columbia should consist of a reception room, a small private office for the principal, and a storage room for school supplies and textbooks. The committee also believes that a teacher's rest room should be provided. In some cities a sort of combination lunch room and rest room is fitted up for teachers. In some cases teachers have assisted in the establishment of professional libraries in such rooms and have done much professional and general reading as well as some of their school work there. Provisions for decent comfort of the teaching staff was commonly neglected in the older structures, but it is coming to be a recognized feature of modern school buildings.

The Committee believes that the time will come when Columbia will provide a school nurse. Many communities now believe a school nurse to be an indispensable part of the school organization. They have found that a school nurse is often much more serviceable in improving attendance than the ordinary attendance officer. School nurses have been of the greatest service in connection with checking the spread of contagious diseases and in educating teachers in the care of minor illnesses and in the detection of the symptoms of contagious diseases. By assisting in health examinations, school nurses have also been able to locate various eye, ear, nose and throat troubles that have prevented many children from pursuing their school work successfully.

The Committee recommends also that the plans for all the elementary school buildings include a janitor's work room in the basement some-



where near the boiler room. By providing such a room the janitor can keep his tools together instead of having them scattered through various parts of the building. Adequate storage space should also be provided.

### **Additional Playground Space Needed**

While very commendable efforts have been made in Columbia in the direction of enlarging elementary school playgrounds they are not yet by any means, of sufficient size to accommodate the number of pupils that may be expected to attend school at each of these buildings during the next two decades. The minimum desirable size for an elementary school site in the closely built-up section of the city should be one city block. Where sites are available in outlying sections of the city, where land is relatively cheap, at least two blocks or between five and six acres should be provided. For junior high school purposes many cities are now purchasing sites containing from seven to twelve acres. The Survey Committee believes that this is not an unreasonable standard. For senior high school purposes from fifteen to twenty acres is the desirable size. While Columbia is ahead of many cities in the size of school sites provided, she does not yet approximate the standards mentioned above. There are two reasons why large playground areas around the school building are desirable. First of all, they are desirable for outdoor play. An outdoor playground for an elementary school should contain space for many different types of games for children of the various grades. There should be adequate space for playground equipment. The younger children should be able to play without danger of being run over by older children. In the second place, large playground areas are desirable because they constitute an addition to the beauty of the town. Where an elementary school building has a small playground, it is often a very undesirable neighbor. Frequently the price of property depreciates when it is located adjacent to an elementary school building with a small playground, because it is almost impossible to keep the children from finding a place to play in neighboring yards and in the streets when there is no room on the school playground. An elementary school playground containing a block or two blocks may be regarded somewhat in the nature of a park and is a real asset to any section of the city in which it may be located. Junior and senior high school grounds of the size indicated may be looked on as combination parks and playgrounds. They may be used at some time during the year by a large portion of the population of the city, and they add to the appearance of the city in the same manner that public parks would add. The Survey Committee does not believe it necessary to go into the defects of the various school buildings in Columbia because, as has been previously said, the buildings

represent very much more than one would expect for the amount of money expended.

### **More Adequate Fire Protection Needed.**

On the item of fire protection, however, the buildings of Columbia do not score high because none of them is fire proof. They belong to what architects call "Type C" construction. It would have been impossible to have constructed fire proof buildings for the amount that Columbia has invested in her school plant. The committee, however, very earnestly recommends that all the school buildings constructed in Columbia in the future be of "Type A" construction absolutely fire proof throughout. The only exception to this recommendation would be where a single story elementary school building is constructed with an outside exit for every classroom, and with the heating plant located out from under the building. In the case of such a building "Type B" or "Type C" construction might suffice.

■ For buildings whose immediate replacement is not planned the Survey Committee recommends the following measures looking toward increased protection to the children.

1. Provide small fire extinguishers on each floor and in the basement with one for each 2000 feet of floor space. Additional extinguishers should be furnished for manual training rooms.
2. For buildings such as the Benton and Lee and perhaps, also the Grant at least one reel of fire hose should be provided. It should be tested by the janitor at frequent intervals.
3. Panic bolts should be provided on all outside doors and these panic bolts should never be locked while any children are in the building.
4. The rooms containing the heating plant and fuel rooms should be made fireproof and should be shut off from the remainder of the building by means of self closing fire doors.
5. In two-story buildings of "Type C" construction having only one stairway, at least one outside fire-escape should be provided. The Committee does not believe much in the safety afforded by outside fire escapes but they seem necessary where there is only one stairway to the second story of a type C building. Outside fire escapes should, by no means take the place of the other safety provisions recommended.
6. The school building should be connected with the city fire alarm system.

7. All storage spaces under stairways where inflammable material is often stacked should be done away with. Metal waste cans should be provided for storing waste paper, etc., and wire cages should be provided for the burning of waste paper.

### The High School Building As a Special Case.

The high school building score is not included in Table II because it was scored by means of a special form of the score card devised and standardized for secondary school buildings. A sample of this score card is reproduced in the appendix. A different rating scheme is necessary for a high school building because it must have distinctive features in the way of study halls, libraries, gymnasiums, assembly room, cafeteria, laboratories, shops, etc. The statements made above about the meaning of the scores apply to the score of the high school building, but it must be remembered that this building is judged by different standards—those that should be met by a high school building.

The present high school building scores 560 points—on the basis of 1000 points for a perfectly satisfactory high school plant.

It may be wondered why a building erected fifteen years ago and designed especially for high school purposes should score that low at the present time. In order to answer this question the score of the building is presented by major items of the score card in Table IIIA.

TABLE IIIA  
THE HIGH SCHOOL BUILDING SCORE

	Perfect Score (a)	Columbia High School (b)	Percentage Scores (c)
Item I Site .....	100	70	70.0
Item II Building .....	155	121	78.1
Item III Service System.....	270	180	66.7
Item IV Classrooms or Recitation Rooms.....	145	108	74.5
Item V Special Classrooms .....	140	38	27.1
Item VI General Service rooms.....	140	35	25.0
Item VII Administration Rooms.....	50	8	16.0
Totals.....	1000	560	56.0

The first column of figures in this table show the standard score on each item. A high school building perfect in every detail would score a total of 1000 points. The total score of the Columbia high school building is only 56 per cent of this amount. An examination of the third row of figures in Table IIIA shows that on items 1, 2, 3 and 4, the building scores fairly high. The average percentage score on these four items is 72.3. If the building scored as high on the other items as it does on the first

four, the total score of the building would be 723. The size of the site does not measure up to the most acceptable standard for high school purposes. Instead of a three or four acre site there should be a site containing at least fifteen or twenty acres of ground. On the items of special classrooms, general service rooms, and administrative rooms the scores fall respectively to 27, 25, and 16 per cent of what standard scores should be. In other words, the building is well constructed and is quite satisfactory from a mechanical standpoint, but it is noticeably lacking in those other things which provide for the special purposes which should be served by a high school building. It should be pointed out that in scoring this building the number of students to be accommodated was taken into consideration. From this point of view, the building is now quite inadequate although it seemed sufficiently large fifteen years ago. In examining this building one finds a lack of proper shower bath facilities; inadequate auditorium space; a very inadequate gymnasium; no music room, special study halls or special library room worthy of the name; a badly overcrowded typewriting room; a lack of a special book-keeping room and no commercial laboratory. Indeed, one finds that many of the special provisions for modern high school work are entirely lacking. For example, there is no chemistry laboratory, no model house-keeping suite, no clothing laboratory, no dress making laboratory, and the industrial art shops consist only of a woodworking shop and a mechanical drawing room. The administrative rooms consist of a principal's office and the superintendent's office. The principal may be said not to have an office since it is the assistant principal's office, the reception and waiting room, the general supply room, the teachers' preparation room, etc. Such features as health service rooms, medical clinic, student activity room, etc., are entirely lacking. The high school building then, while in good condition as a structure, is much too small for the number of students that must be accommodated in the Columbia High school, and does not contain the provisions that are now considered necessary for modern high school work.

## THE INDIVIDUAL BUILDINGS

### The Jefferson School.

#### Score 362.

This building located at 7th and Rogers streets is an eight room "Type D" structure with furnace heat. It was erected in 1899 at a cost of \$18,000. It is now being used to house the seventh grade. For this purpose it is, so far as space is concerned, about as inadequate as could be imagined. The library is located in what was formerly a cloak room,

9 by 7 feet in size. The sewing room was also formerly a cloak room of about the same dimensions. Another small clock room has been utilized as a storage room for manual training supplies and two others as storage space for home economics, science and art supplies. There is, of course, no provision for a gymnasium, and on the day when this building was visited the physical training class was taking its exercise in a dark, dingy basement hall. The building is of the box type with inadequate natural lighting coming from two directions in practically every classroom. The building is a fire trap of the worst sort, and because of its age and general unsuitability for school work, the Committee recommends that it be abandoned as soon as other provisions may be made for the junior high school grades.

### **Benton**

#### **Score 439.**

This building is a "Type D" brick structure containing six classrooms, one domestic science room and one manual training room. The original part was erected in 1896 and the addition in 1914. It is of the box type somewhat similar to the Jefferson building and is a fire trap to almost the same degree as the Jefferson. The toilet rooms are located in the basement, the classrooms have bilateral lighting, the building has inadequate artificial lighting particularly in the industrial and household arts rooms where there are only four small windows with no artificial lighting whatever. The household and industrial arts rooms are a part of the one story addition erected in 1914. The outside walls of the older portion of this building are cracked. There is some question about the safety of the building. From such examination as the Survey Committee was able to make, it is not believed that these cracks in the walls indicate that there is any danger of the building falling down. It would probably stand for many years. The Survey Committee understands that the board of education has had this building examined by engineers and they have reported that there seems to be no immediate danger from the cracked walls. Because of the fact that this building is of an antiquated type and because its interior is constructed of quick burning material, it is recommended that it be replaced in the near future. The Committee recognizes, of course, that there are many hundreds of elementary school buildings now being used in the State of Missouri that are in much poorer condition than the Benton school. Some of these buildings will continue to be used for ten or fifteen years in the future. The Committee, however, does not believe that in a community as wealthy as Columbia such a practice should be followed. Its early replacement is therefore recommended.

**Robert E. Lee****Score 461.**

The Lee school located at Locust and Waugh consists of six classrooms, one room for domestic science and one for manual training. The first of the building was constructed in 1904 and the addition in 1916, the total cost of the building being \$16,600. It is a "Type D" building of the box type with unilateral lighting for the most of the classrooms. It has a Louis and Kitchen Hot Air Heating system for the four rooms in the old building re-inforced by steam in the west rooms. It has a store-room under the stairway, unsanitary toilets, inadequate artificial lighting, and non-adjustable seats and desks. In some rooms the committee found boxes which the pupils had brought into the room to keep their feet from dangling while they were seated at work. There is a great deal of waste space on the first floor and in the basement of this building. The cloak rooms are not ventilated and only dark green shades hung from the top were provided. In spite of the fact that this building offers very great fire hazards, the doors were not equipped with panic bolts. The toilet rooms were located in the basement which is the common practice in the elementary school buildings of Columbia. Without going into too much detail, it may be said that on the whole the Lee school represents an antiquated type of elementary school building very insufficiently supplied with special rooms. It is recommended that this building be replaced as an early part of the school building program proposed for Columbia and that it be re-located on a site approximately a quarter of a mile southeast of the present site so that it will better serve the population growth which seems almost sure to come in the southeastern section of the city.

**Grant School****Score 593.**

The Grant school is a seven-room, steam-heated brick structure of the "Type D" construction, erected in 1910 at a cost of \$20,000. It is located at Broadway and Garth avenue. Because of the small amount of money invested in this building, it has many weaknesses. The Committee, however, was impressed with the fact that a great deal was secured in this building for the investment. No special improvements or additions are recommended for this building because the Survey Committee believes that with the probable expansion of Columbia to the southwest, this building will prove to be improperly located. It is, therefore, recommended that when it becomes over-crowded to such an extent that it will not care for the population of the area in which it now serves, a new

building shall be started on the site approximately a quarter of a mile to the southwest. As soon as possible after the beginning of such a building, it is recommended that it be enlarged so as to provide for all the students who now attend the Grant school. Instead of making improvements in the Grant school building, the Committee believes that it would be more economical all around to construct an entirely new building on another and better located site.

### **Eugene Field School**

#### **Score 598.**

The Eugene Field school located at Range Line and Smith street is a brick structure containing six rooms erected in 1916 at a cost of \$30,000. It has steam heat, and impressed the survey committee as being a well-built building. At the time it was visited by the Committee it showed evidence of exceptionally good care; that is, the building was clean throughout and apparently showed much pride in its care by pupils as well as those in charge of the school. This building, of course, does not have the necessary special rooms and it will soon be too small to care for the increase of population in that section of the city. In another section of the report it is recommended that when the Benton school is replaced the building be made large enough to take care of, temporarily at least, a number of pupils from the Eugene Field area. At some future time this building should be enlarged by providing a combined gymnasium-auditorium, additional classrooms and other special rooms which will make it fully modern.

### **Ridgeway Elementary School**

#### **Score 620.**

The Ridgeway elementary school building located on Sexton Road near Grand avenue was completed in 1923 at a cost of about \$49,500. This building scores higher than the Eugene Field although in many ways it is an inferior structure. It scores higher because it has more of the special features that are adapted to modern elementary school instruction. There is a playroom not quite large enough to be called a gymnasium, and it is possible to throw two elementary classrooms together so as to provide something in the nature of an assembly room. A stage is also provided. There are special rooms for home economics and manual training and some other very desirable special features. On many of the finer points of size and arrangement of classrooms, cloak rooms, corridors, toilets, etc. this building has serious defects. It will, however, be a fairly serviceable building for many years in the future. Owing to the increase

in population in the northwest section of Columbia, it now appears quite obvious that this building should have been located further to the west. It should, of course, not be replaced until it has been used throughout its natural life. It is recommended, however, that the school board look a long way ahead in dealing with the elementary school building situation in the northwest portion of Columbia, and that it buy a site which will be the site of the ultimate elementary school for that section of the city. Whenever it becomes impossible to take care of the children from the Ridgeway school area by other means, it is recommended that a new school building be begun on the site suggested above. When the Ridgeway building has been used throughout its natural period of usefulness, it is recommended that it be abandoned and this new building be enlarged so that it will care for all the white students west of the Eugene Field area and north of the Grant school area.

### **Fred Douglas (colored)**

#### **Score 552.**

The Douglas school located at Third street and Park Ave. is a brick structure containing fifteen rooms, erected in 1917, at a cost of \$36,000. It is heated by steam and accommodates both high school and elementary school students. The building is remarkably well built, although in the provision of cloak rooms, assembly room, gymnasium, shower baths, administrative offices, shops, laboratories and classrooms, it is now quite inadequate to serve the needs of the colored pupils. It is recommended that an addition be made to this building to cost from \$30,000 to \$40,000 so that a combined auditorium and gymnasium, shops and two or three additional classrooms may be provided. It is believed that with such an addition the building will be adequate to serve the colored population of Columbia during the next twenty years. It is also recommended that an addition be made to the site of the building.

### **High School**

#### **Score 560.**

The high school building located at 8th and Rogers street is a brick structure containing thirty-two rooms with direct mechanical heating and ventilation. It was erected in 1910 at a cost of \$105,000. At the time of its construction it was adequate to take care of the number of high school students in Columbia. Since that time the high school population has more than doubled and many extensions have been made in types of work now considered necessary for high school pupils. The building, consequently, became so overcrowded during the school year 1923-24



that it was necessary to start the school year 1924-25 with double sessions permitting half the pupils to attend in the morning and half to attend in the afternoon. This building, which has already been described, is not only too small, but is unfitted by reason of its lack of special provisions for high school instruction in Columbia. It is, therefore, recommended that the first step of the school building program in Columbia be the construction of a senior high school building. It is recommended that the present high school building be taken over for junior high school purposes. The location proposed for this building is discussed elsewhere in this report.

### Summary

1. For the amount of money invested, Columbia seems to have a much better school plant than one might be led to expect.

2. The school plant of Columbia may be said to be an average one with no disgracefully poor buildings and no exceptionally good ones.

3. According to the scores of the elementary school buildings, it would appear that the Jefferson should be placed first on the replacement program followed in order by the Benton and Lee.

4. The high school building has become so overcrowded that it is necessary to have half-day sessions, thus seriously interfering with the efficiency of high school work. While this building is structurally in good condition, it does not contain the space and the special provisions necessary for modern high school work. Another section of the report recommends that this building be taken over for Junior high school purposes, and that a new high school building be constructed as the first part of the school building program for Columbia.

5. It is recommended that the policy be adopted of providing much larger playgrounds for all types of schools wherever such space may be acquired.

6. It is recommended that all future school buildings constructed in Columbia be of "Type A" construction except that "Type B" or "C" construction may be used for single story elementary schools that have an outside door to every classroom, and a heating plant located out from under the building.

7. It is recommended that no construction be undertaken until such time as the city can afford the erection of buildings that are first rate in every particular. It is ordinarily the poorest of economy from an

educational and economic point of view to consider mediocre school buildings.

8. It is evident from a study of the school plant of Columbia that the city is faced by a school building program of rather large dimensions. This fact becomes all the more apparent when the probable increase in the school enrollment due to population increase is considered. An estimate of the increase in population which seems likely for Columbia, will be presented in Chapter III. The chapter which follows this will deal with the type of school organization for which the buildings of the future are recommended.

## CHAPTER II.

### THE JUNIOR HIGH SCHOOL ORGANIZATION AND THE BUILDING PROGRAM.

In the preceding chapter some facts have been presented to show that the school building plant of Columbia is in such a condition that extensive improvements will have to be made in the immediate future. Attention was called to the lack of many essential features in the elementary school plant and particular emphasis was placed on the fact that the seventh grade is housed in what seems to be decidedly the poorest all around school building in the city. It was pointed out that the high school building is no longer adequate to care for anything like the number of pupils now enrolled and that the building is lacking in most of the special features now considered essential for senior high school students. Before going to a discussion of the inadequacy of the present school buildings in connection with the probable number of pupils that must be accommodated in the future, it seems desirable to present in this chapter some considerations bearing on the kind of school organization for which the future building should be planned. This is obviously necessary, because if the seventh grade pupils are to be housed in buildings with the first six grades, a very different sort of elementary school building must be constructed than would be necessary if only the first six grades are to be accommodated. If the seventh grade is to occupy a building all to itself, it must be a very different sort of building in size, special features, laboratories, shops and classrooms from one designed to house grades seven, eight and nine. It is well-known that fact there are many types of school organization. The oldest and most frequent form in this country is the 8-4 plan where the first eight grades are housed together as elementary schools and where grades 9 to 12 constitute the high school. Other cities have what they call 6-6 plan with six grades in the elementary school and six in the high school. Others, including many of the most progressive cities of the country, have during the past two decades adopted the 6-3-3 plan of organization with grades 1 to 6 in elementary schools, grades 7 to 9 in junior high schools, and grades 10 to 12 in senior high schools. Columbia and one or two other Missouri cities have had a 7-4 plan of organization which is quite common in some cities of the southern states.

#### Changes in Organization Plans in Columbia.

Columbia had an 8-4 plan of organization up to 1904 when the eighth grade was discontinued and the school system was administered

on the 7-4 plan until the beginning of the year 1923-24. In that year a few pupils who were weak in the seventh grade the previous year were tentatively organized as an eighth grade. This grade was continued in the fall of 1924 and at this time its membership is made up partly of pupils who were weak in the seventh grade work and partly of pupils coming to Columbia from the seventh grade of other systems organized on the 8-4 plan. The Survey Committee understands that in the spring of 1925 all seventh grade pupils who make "M" or better will be admitted to high school; that in the spring of 1926 only those will be admitted who have made "S" or "E"; and that thereafter all pupils will be required to take the eighth grade work. The decision to require all pupils to take the eighth grade work was made because of doubt concerning the ability of the average pupil to master in seven years the work allotted to the elementary school. The 7-4 plan was inaugurated in 1904 in the belief that eight years were not required and that by eliminating the eighth grade a whole year would be saved to the pupil.

### How The 7-4 Plan Has Worked.

It is a matter of common knowledge that graduates of the Columbia high school seem to succeed as well in the University and in life as the graduates of other high schools. If pupils in the Columbia public schools save a year of time, the present plan is not one to be discarded except for unusually weighty reasons. Before going to a discussion of the educational issues involved, it would be well to answer the question: how much time do pupils in Columbia save under the 7-4 plan of organization? Some of the facts bearing on this question are presented in Table IV which compares the median age of pupils in each of the four grades of the Columbia High School with the median ages of pupils in the corresponding grades of the high schools in seven other cities which, because of population and other conditions seem to have a situation comparable to that of Columbia.

TABLE IV  
MEDIAN AGES OF HIGH SCHOOL PUPILS BY YEARS IN  
EIGHT CITY SCHOOL SYSTEMS—1923-24.

City	Freshman	Sophomore	Junior	Senior
Columbia -----	14-4.8	15-4.2	15-11.7	17-2.6
St. Charles -----	14-9.0	15-5.1	16-4.1	17-1.6
Chillicothe -----	14-6.2	15-4.4	16-6.4	17-3.8
Jefferson City -----	14-7.5	15-4.5	16-5.6	17-7.7
Sedalia -----	14-7.1	15-9.5	16-6.8	17-4.1
Nevada -----		15-4.6	16-6.4	17-7.7
Independence -----	14-10.6	15-5.9	16-6.1	17-6.0
Hannibal -----		15-7.1	16-6.8	17-4.7

### Little Time Saved For Students By 7-4 Plan.

This Table shows that the pupils of Columbia save some time by going through an eleven-year course instead of a twelve-year course, but it shows quite strikingly that the amount of time saved does not amount to a full year as compared with the results obtained by other school systems in Missouri. In Columbia the median age of students in the ninth grade is a little less than fourteen years and five months. Students in Columbia then may be said to reach the ninth grade four months younger than the median student in St. Charles, a little over a month younger than the average student in Chillicothe, two and one-half months younger than the average student in Jefferson City, two months younger than the average student in Sedalia, six months younger than the average student in Independence.

In no case is the difference more than one-half year. By the time the Columbia high school students enter the senior year they are, on the average, seventeen years, two and one-half months of age. The median age of Columbia high school seniors is one month greater than the median age of seniors of St. Charles, showing that it is possible to get students through a twelve-year course more quickly than to get them through an eleven-year course. High school seniors in Columbia are, on the average only 1.2 months younger than high school seniors in Chillicothe, 5.1 months younger than those of Jefferson City, 1.5 months younger than those of Sedalia, 5.1 months younger than those of Nevada, 3.4 months younger than those of Independence, and 2.1 months younger than those of Hannibal. The average amount of time saved for students of the Columbia Public Schools by having eleven years of school instead of twelve, appears to be only about two and one-half months.

On account of the favorable educational situation in Columbia it is entirely possible that, if students were provided with twelve grades instead of eleven, they might be expected to complete the work so as to graduate from high school at a younger average age than at present. The chief point of all this is that the 7-4 system of school organization which Columbia has had since 1904 has, in actual practice, saved very little time for the students. They are just about as old when they graduate from high school as are the students in cities that have continued an 8-4 or 6-3-3 plan of organization.

The question may be asked as to why the students in Columbia public schools do not graduate from high school at a much earlier age than they do in cities where twelve years of school work are provided. The answer to this question is not a simple one. It might be urged that a certain degree of maturity is required for the average student to complete the high school course as it is outlined at the present time, and that

students tend to be held in school until this average standard of maturity is reached irrespective of whether the grades are eleven or twelve in number. There may be some truth in this statement, but it appears from a careful study of the classification and promotion of pupils in the elementary grades of the Columbia public schools that much of the "holding back" occurs in the grades below the high school.

### **Much Slow Progress In First Six Grades.**

Table V contains a summary of the classification of pupils in the Columbia public schools by ages and grades. This table is inserted to show the extent of over-ageness in the first six grades. It shows a rather striking amount of over-ageness in the elementary schools of Columbia. The percentage of pupils in the first grade who are over-age is only 23.5, but in the second grade the percentage increases to 35.7. It reaches a maximum of 45.2 per cent in the fourth grade and in the sixth grade the percentage is 43.1. Thirty-nine and six tenths per cent of the 1194 pupils whose records were studied in grades one to six are over-age for the grades in which they were classified.

Table VI shows the extent of over-ageness by grades. That is, it shows the number who are one-half year above normal age for their grade, the number one year above normal age, the number one and one-half years, two years, two and one-half years, and so on. Stated in the equivalent of years the amount of over-ageness represents  $746\frac{1}{2}$  years which would be the equivalent of 746 children going to school for an entire year. The unusually large amount of over-ageness could be explained in only one of two ways. Either pupils do not enter promptly at the age of six, or they are frequently failed in their school work and forced to repeat grades. A study of the age at which pupils enter the first grades of the public schools in Columbia shows that it is, on the average, no greater than the average entering age in other cities. The most conclusive evidence on this point, however, is shown in Table IV which indicates the rate at which pupils progress through the grades of the Columbia public schools. This table shows that in the first grade 75 per cent of the pupils have made normal progress—that is, they are doing the work of the first grade for the first time. About 25 per cent of the pupils in the first grade are repeating a part or all of the work. In the second grade 50 per cent of the pupils have made normal progress while 47.3 per cent have either repeated the work of the first grade or are repeating the work of the second grade. In the third grade the number of pupils who have failed or repeated one or more grades is 54.8 per cent. Of the pupils enrolled in the fifth grade in all the elementary schools of Columbia 65.5 per cent have some time during their school years repeat-

TABLE V  
AGE-GRADE TABLE OF THE COLUMBIA PUBLIC SCHOOLS (WHITE).  
AGES TAKEN AS OF SEPT. 1, 1923.

Age	Grades						Total
	I	II	III	IV	V	VI	
5.....	1						1
5½.....	10						10
6.....	83	2					85
6½.....	58	10					68
7.....	38	45					83
7½.....	23	40	9	1			73
8.....	11	32	38	5			86
8½.....	9	23	38	9	1		80
9.....	2	13	29	39	2	1	86
9½.....	6	8	26	28	12	1	81
10.....	5	5	14	32	33	5	94
10½.....	0	6	15	22	27	6	76
11.....	2	5	14	18	18	21	78
11½.....		5	7	15	20	25	72
12.....		0	3	14	22	22	61
12½.....		3	3	10	30	19	55
13.....		0	2	5	11	13	31
13½.....		1	2	4	12	16	35
14.....		0	1	1	8	5	15
14½.....		1	0	2	2	2	7
15.....			1	3	2	3	9
15½.....			0	0	2	1	3
16.....			1	0	1	0	2
16½.....			0	0	1	2	3
Total.....	248	199	203	208	194	142	1194
No. U. A.....	11	12	9	15	15	13	75
No. N. A.....	179	117	105	99	78	68	646
No. O. A.....	58	70	89	94	101	61	473
% U. A.....	4.4	6.0	4.4	7.2	7.7	9.1	6.3
% N. A.....	72.1	58.3	51.7	57.6	52.1	47.8	54.1
% O. A.....	23.5	35.7	43.9	45.2	40.2	43.1	39.6

TABLE VI  
EXTENT OF OVER-AGENCY BY GRADES

Grade	Years Over-age														Total
	½	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	
I	23	11	9	2	6	5	0	2	0	0	0	0	0	0	58
II	23	13	8	5	6	5	5	0	3	0	1	0	1	0	70
III	26	14	15	14	7	3	3	2	2	1	0	1	0	1	89
IV	22	18	15	14	10	5	4	1	2	3	0	0	0	0	94
V	20	22	20	11	12	8	2	2	2	1	1	0	0	0	101
VI	19	13	16	5	2	3	1	0	2	0	0	0	0	0	61
Total	133	91	83	51	43	29	15	7	11	5	2	1	1	1	473
Equiva- lent in Yrs.	62½	91	124½	102	87½	87	52½	28	49½	25	11	6	6½	7	740

ed one or more grades. For all the elementary school pupils in the first six grades the percentage of those who have repeated grades is 45.7.

The pupils whose records are summarized in Table VII were the pupils who had spent their entire school careers in the public schools of Columbia. Any pupil who had not done all his work in the elementary schools of Columbia was thrown out of the tabulation. This table shows also that while the percentage of pupils who fail and are forced to repeat grades is unusually large, the percentage of those who are allowed to skip grades so as to make rapid progress is practically negligible, amounting to only 1.2 per cent of all the pupils studied in grades one to six. It appears then that for some reason, possibly because of the necessity of crowding so much work into the first seven grades, the teachers of Columbia have found themselves working under the necessity of maintaining a very rigid promotion scheme so that children have been held back and forced to repeat grades until, by the time they reach the high school, they have lost a sufficient amount of time to offset in large measure the absence of an eighth grade.

TABLE VII

GRADE-PROGRESS TABLE FOR THE COLUMBIA PUBLIC SCHOOLS. (WHITE)  
CLASSIFICATION TAKEN AS OF SEPT. 1, 1923.

Years In School Previous to This	1	2	3	4	5	6	Total
0.....	151						151
½.....	2	4					6
1.....	40	73					113
1½.....	0	3					3
2.....	5	41	66				112
2½.....	0	1	1	1			3
3.....	2	13	41	57	1	1	115
3½.....	0	1	1	0	1	0	3
4.....	1	7	21	32	30	1	92
4½.....		0	0	0	1	0	1
5.....		3	12	14	17	28	74
5½.....			0	0	3	0	3
6.....			3	12	22	14	51
6½.....			0	0	0	1	1
7.....			0	1	13	13	27
7½.....			0	0	0	0	0
8.....			1	0	5	0	6
8½.....						0	0
9.....						0	0
9½.....						0	0
10.....						1	1
Total.....	201	146	146	117	93	59	762
No. Rapid Prog. ....	0	4	0	1	2	2	9
No. Normal Prog. ....	151	73	66	57	30	28	405
No. Slow Prog. ....	50	69	80	59	61	29	348
% Rapid Prog. ....	0	2.7	0	.9	2.1	3.4	1.2
% Normal Prog. ....	75.1	50.0	45.2	48.6	32.3	47.5	53.1
% Slow Prog. ....	24.9	47.3	54.8	50.5	65.6	49.1	45.7



Table VIII shows the extent of slow progress made by the 348 pupils who have made slow progress in the first six grades. The table shows that seven of the 348 slow progress pupils repeated one-half year of work; 185 repeated one year; six repeated one and one-half; 88 repeated two years, and so on. There are thirteen pupils who have apparently repeated four years of school work; one pupil who has repeated five years, and one who has spent twelve years in doing the work of the first six grades. The total amount of retardation due to having these pupils repeat grades is 577 years. In other words, the pupils of the first six grades have lost enough time by repeating grades during the time they have been in school to amount to the equivalent of 577 pupils going to school for an entire year. At current educational cost this represents a loss of something like \$35,000 to say nothing of time lost by the pupils. Perhaps this loss of time and money is necessary under the 7-4 plan of organization, but it is certainly quite possible to reduce it very much below the present amount by providing a scheme of organization which will make possible a more flexible promotional plan.

TABLE VIII  
EXTENT OF SLOW PROGRESS BY GRADES

Grade	No. of Years Retarded												No. of Pupils	Amount of Retardation
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$	6		
I.....	2	40	0	5	0	2	0	1	0	0	0	0	50	61 Years
II.....	3	41	1	13	1	7	0	3	0	0	0	0	69	105 $\frac{1}{2}$ Years
III.....	1	41	1	21	0	12	0	3	0	0	0	1	80	139 Years
IV.....	0	32	0	14	0	12	0	1	0	0	0	0	59	100 Years
V.....	1	17	3	22	0	13	0	5	0	0	0	0	61	125 Years
VI.....	0	14	1	13	0	0	0	0	0	1	0	0	29	46 $\frac{1}{2}$ Years
Total.....	7	185	6	88	1	46	0	13	0	1	0	1	348	577 Years
Equivalent in Years .....	$3\frac{1}{2}$	185	9	176	$2\frac{1}{2}$	138	0	52	0	5	0	6		577 Years

### Some Educational Reasons Supporting The 6-3-3 Plan.

#### Less Formalized Repetition.

The failure of the 7-4 plan to get pupils through the high school at a decidedly earlier age than in other school systems is not the most serious argument that might be urged against it. Many of the more progressive cities of the country have adopted the 6-3-3 plan of school organization because of the sound educational principles that seem to support it. The first cause that has been influential in the adoption of this plan in many cities is closely related to the reason that led the Columbia board of

education to abolish the eighth grade in 1904. It has been felt for many years by those familiar with conditions in the seventh and eighth grades that there was a great deal of waste of time caused by repetition of subject matter which was more or less the same in the seventh and eighth grades as the material covered by students in the first six grades. There has not been perhaps so much repetition of identical material as many people have supposed, but there has been a continuation of a kind of more or less formal work the relation of which to real life purposes has not been apparent to many of the pupils. Consequently, pupils have either dragged along until they got to high school or they dropped out because the work did not appeal to them as being worth while.

### **A Broader and More Interesting Curriculum.**

It is a fact well known to those who have observed pupils in the seventh, eighth and ninth grades that at this period real life interests begin to develop. Pupils begin to look for meaning in what they do. Because of this fact, junior high schools have been established in many cities so that the developing interests of boys and girls might be more fully utilized in their work. It seems to be a sound educational principle that during the period covered by the seventh, eighth and ninth grades, boys and girls should have an opportunity to explore their various interests, to try themselves out in many kinds of work so as to know themselves well enough to be able to decide intelligently on the future lines of educational work which they should individually pursue. Consequently, we find many junior high school courses that are called broadening and finding courses which are nothing more than a wide variety of courses calculated to bring boys and girls into touch with a wide range of information about the world's activities so that they may more intelligently decide on those activities that challenge their greatest interests and fall most in line with their peculiar abilities. It is not the purpose of this survey to enter into any discussion of curriculum offerings except insofar as they relate to this general principle. The courses given in the seventh and eighth grades in Columbia at the present time are shown in Table IX.

A junior high school curriculum in which a much wider range of activities is provided is illustrated in Table X. This curriculum is not suggested as a model one for Columbia or any other city, but is simply an illustration of the fact that with the Junior high school organization it would be possible to offer a much more interesting and stimulating type of work than is commonly possible under such an organization as has been maintained in Columbia during the past.

TABLE IX  
CURRICULUM FOR SEVENTH AND EIGHTH GRADES  
IN COLUMBIA.

Seventh Grade	Eighth Grade
Arithmetic	English
English	Arithmetic
History	Community Problems
Geography	General Science
Manual Training	Manual Training
Domestic Science	Domestic Science
Handwork	Handwork
Drawing	Drawing
Music	Music
Physical Training	Physical Training
Penmanship	Penmanship

TABLE X  
TYPE OF PROGRAM OF STUDIES AND CURRICULA IN A JUNIOR HIGH SCHOOL

Electives	Constants	Electives
*Industrial Drawing..... $\frac{1}{4}$	English..... $\frac{1}{2}$	Modern Languages..... $\frac{1}{2}$
*Wood Work..... $\frac{1}{4}$	U. S. History..... $\frac{1}{2}$	*Music (Voice & Inst.)..... $\frac{1}{4}$
7 *Metal Work..... $\frac{1}{4}$	Physical Ed..... $\frac{1}{4}$	Dramatics..... $\frac{1}{4}$
B *Elem. Bus. Methods..... $\frac{1}{4}$	Natural Science..... $\frac{1}{4}$	*Art Appreciation..... $\frac{1}{4}$
Elem. Agriculture..... $\frac{1}{4}$	Mathematics..... $\frac{1}{4}$	*Drawing..... $\frac{1}{4}$
		Painting..... $\frac{1}{4}$
*Industrial Drawing..... $\frac{1}{4}$	English..... $\frac{1}{2}$	Modern Languages..... $\frac{1}{2}$
*Wood Work..... $\frac{1}{4}$	U. S. History..... $\frac{1}{2}$	*Music (Voice & Inst.)..... $\frac{1}{4}$
7 *Metal Work..... $\frac{1}{4}$	Physical Education..... $\frac{1}{4}$	Dramatics..... $\frac{1}{4}$
A *Elem. Bus. Methods..... $\frac{1}{4}$	Natural Science..... $\frac{1}{4}$	*Art Appreciation..... $\frac{1}{4}$
Elem. Agriculture..... $\frac{1}{4}$	Mathematics..... $\frac{1}{4}$	Painting..... $\frac{1}{4}$
Home Economics..... $\frac{1}{4}$		*Drawing..... $\frac{1}{4}$
*Industrial Drawing..... $\frac{1}{4}$	English..... $\frac{1}{2}$	Modern Languages..... $\frac{1}{2}$
*Wood Work..... $\frac{1}{4}$	Social Studies..... $\frac{1}{2}$	*Music (Voice & In.)..... $\frac{1}{4}$
8 *Metal Work..... $\frac{1}{4}$	Physical Education..... $\frac{1}{4}$	Dramatics..... $\frac{1}{4}$
B *Printing..... $\frac{1}{4}$	Natural Science..... $\frac{1}{4}$	*Art Appreciation..... $\frac{1}{4}$
*Elem. Bus. Methods..... $\frac{1}{4}$	Mathematics..... $\frac{1}{4}$	*Drawing..... $\frac{1}{4}$
Elem. Agriculture..... $\frac{1}{4}$		*Painting..... $\frac{1}{4}$
Home Economics..... $\frac{1}{4}$		Clay & Pottery..... $\frac{1}{4}$
*Industrial Drawing..... $\frac{1}{4}$	English..... $\frac{1}{2}$	Modern Languages..... $\frac{1}{2}$
*Wood Work..... $\frac{1}{4}$	Social Studies..... $\frac{1}{2}$	*Music (Voice & In.)..... $\frac{1}{4}$
*Metal Work..... $\frac{1}{4}$	Physical Education..... $\frac{1}{4}$	Dramatics..... $\frac{1}{4}$
8 *Printing..... $\frac{1}{4}$	Natural Science..... $\frac{1}{4}$	*Art Appreciation..... $\frac{1}{4}$
A *Elem. Bus. Methods..... $\frac{1}{4}$	Mathematics..... $\frac{1}{4}$	*Drawing..... $\frac{1}{4}$
Elem. Agriculture..... $\frac{1}{4}$		*Painting..... $\frac{1}{4}$
Home Economics..... $\frac{1}{4}$		Clay & Pottery..... $\frac{1}{4}$

Courses marked thus (\*) the same course continued.

## SUGGESTED PROGRAM OF STUDIES AND CURRICULA FOR A JUNIOR HIGH SCHOOL.

Electives		Constants		Electives		
9	Industrial Drawing.....	$\frac{1}{4}$	English.....	$\frac{1}{2}$	Foreign Language.....	$\frac{1}{2}$
	Wood Work.....	$\frac{1}{4}$	Physical Education.....	$\frac{1}{4}$	Music (Voice & Inst.).....	$\frac{1}{2}$
	Metal Work.....	$\frac{1}{2}$	Community Civics.....	$\frac{1}{4}$	Dramatics.....	$\frac{1}{4}$
	Printing.....	$\frac{1}{2}$	General Science.....	$\frac{1}{4}$	Algebra.....	$\frac{1}{2}$
	Electricity.....	$\frac{1}{4}$			Debating & Oratory.....	$\frac{1}{4}$
	Gas Engine.....	$\frac{1}{4}$			Art Appreciation.....	$\frac{1}{4}$
	Cement Work.....	$\frac{1}{4}$			Drawing.....	$\frac{1}{2}$
	Bookkeeping.....	$\frac{1}{2}$			Painting.....	$\frac{1}{2}$
	Stenography.....	$\frac{1}{2}$			Clay & Pottery.....	$\frac{1}{4}$
B	Typewriting.....	$\frac{1}{2}$			Botany.....	$\frac{1}{2}$
	Bus. Arithmetic.....	$\frac{1}{4}$			History.....	$\frac{1}{2}$
	Agriculture.....	$\frac{1}{2}$				
	Home Economics.....	$\frac{1}{2}$				
9	Industrial Drawing.....	$\frac{1}{4}$	English.....	$\frac{1}{2}$	Foreign Language.....	$\frac{1}{2}$
	Wood Work.....	$\frac{1}{4}$	Physical Education.....	$\frac{1}{4}$	Music (Voice & Inst.).....	$\frac{1}{2}$
	Metal Work.....	$\frac{1}{4}$	Community Civics.....	$\frac{1}{4}$	Dramatics.....	$\frac{1}{4}$
	Journalism.....	$\frac{1}{4}$	General Science.....	$\frac{1}{4}$	Algebra.....	$\frac{1}{2}$
	Printing.....	$\frac{1}{2}$			Debating & Oratory.....	$\frac{1}{4}$
	Interior Decorating.....	$\frac{1}{4}$			Art Appreciation.....	$\frac{1}{4}$
	Home Nursing.....	$\frac{1}{4}$			Drawing.....	$\frac{1}{2}$
	Cement Work.....	$\frac{1}{4}$			Painting.....	$\frac{1}{2}$
	Bookkeeping.....	$\frac{1}{2}$			Clay & Pottery.....	$\frac{1}{4}$
A	Stenography.....	$\frac{1}{2}$			Botany.....	$\frac{1}{2}$
	Typewriting.....	$\frac{1}{2}$			History.....	$\frac{1}{2}$
	Bus. Arithmetic.....	$\frac{1}{4}$				
	Agriculture.....	$\frac{1}{2}$				
	Home Economics.....	$\frac{1}{2}$				

Courses marked thus (\*) the same course continued.

### Better Provision For Dealing With Problems of Early Adolescence.

In addition to providing a wider range of activities, a junior high school organization makes it possible to deal more effectively with the peculiar problems of early adolescence. These problems occur to a greater extent in grades seven, eight and nine than in any other period with which the public schools deal. By grouping together in one school pupils in this period, teachers may be employed who are specialists in dealing with them and the entire organization of the junior high school may be made such as to best provide for the disciplinary problems, social problems and athletic problems common to early adolescence. Those who have observed junior high schools in operation have been impressed by the fact that it is possible to develop quite a remarkable morale among the students of such a school. They have noted also that many of the peculiarly difficult disciplinary problems that have come from having pupils in the earlier period of adolescence associated with students who are either very much older or very much younger than themselves, are avoided.

### **Teachers May Be More Specialized.**

The third educational reason which might be urged in favor of a junior high school organization in Columbia would be that it would be possible to have more specialization among the teachers if a junior high school unit were developed, than under the present plan. If three or four hundred junior high school students were brought together, it would be possible to have a special teacher of science to handle all the work in that subject.

A special teacher of home-making courses could handle all the work in that field. The same thing would be true for other subjects of the curriculum and because of this the teachers might be specialists to a greater degree than at present and it would be possible for them to prepare themselves very much more adequately for the particular kind of work assigned to them.

### **More Economical When Quality of Work is Considered.**

A fourth argument that is commonly urged in favor of the junior high school is that it represents real economy provided the same variety and quality were attempted under the old plan as is contemplated under the junior high school organization. By taking the seventh and eighth grades out of the elementary school no expensive laboratory equipment is necessary because in the first six grades students deal with that fundamental body of information which we believe that all those who are going to be citizens should have. For this training no expensive laboratories or specially equipped shops are necessary. If the seventh and eighth grade pupils were kept at the elementary schools, it would be necessary to provide expensive laboratories and shops if the type of work were offered which would ordinarily be undertaken in a junior high school. When the ninth grade is combined with the seventh and eighth grades, the junior high school laboratories and shops do not need to be so extensive or so costly as those necessary for a senior high school. By grouping together in one building a large number of junior high school pupils these laboratories may be used throughout the entire day, whereas if they were in an elementary school it would be possible to use them for only a small portion every day. A junior high school organization also makes it possible to utilize without waste of time the services of special teachers. If these special teachers had to teach in five elementary schools, they would waste a large portion of their time in going from one building to another.

### **Makes Possible Easier Transition From Elementary to High School.**

Finally, it may be said that the provision of a junior high school organization makes possible a much easier transition from elementary

school to high school than is common under either the 7-4 or the 8-4 plan. The work of the junior high school combines some of the features of elementary school instruction with some of senior high school instruction, so that by the time the pupil finishes the ninth grade, he is able to enter the senior high school without any feeling that he has suddenly been thrown into an entirely different educational atmosphere. Because of the fact that the junior high school makes the transition from the elementary school to the high school much easier, it has been found in many cities that a junior high school organization enables many pupils to complete the high school course who would otherwise drop out sometime during the ninth year. An examination of the enrollment statistics in Columbia over a long period of years indicates that the junior high school grades have not increased in attractiveness to the same extent that is noticeable in the tenth, eleventh and twelfth grades. This fact is indicated quite clearly in Table XI. It shows that while the percentage of all students enrolled in grades ten, eleven and twelve in Columbia has increased from 15.2 in 1908 to 22.4 in 1923, the per cent of all students enrolled in junior high school grades has, on the whole, shown a slight decrease. The Survey Committee believes that with the proper sort of junior high school organization there would be a very decided increase in the percentage of the total school enrollment which would be found in grades seven, eight and nine.

TABLE XI

PER CENT OF TOTAL NUMBER OF PUPILS IN EACH OF SUGGESTED SCHOOL DIVISIONS. COLUMBIA PUBLIC SCHOOLS 1908-1924 (WHITE ONLY)

Year	Elementary	Jr. High	Sr. High	Total
1908-09.....	66.49	18.26	15.25	100
1909-10.....	68.25	15.65	16.10	100
1910-11.....	67.65	15.35	17.00	100
1911-12.....	68.28	15.40	16.32	100
1912-13.....	65.03	16.93	18.04	100
1913-14.....	60.48	19.31	20.21	100
1914-15.....	65.65	15.59	18.76	100
1915-16.....	65.16	16.92	17.92	100
1916-17.....	63.95	17.57	18.48	100
1917-18.....	58.10	20.71	21.19	100
1918-19.....	63.00	17.70	19.30	100
1919-20.....	60.46	21.02	18.52	100
1920-21.....	61.69	18.15	20.16	100
1921-22.....	62.28	17.66	20.06	100
1922-23.....	61.36	15.80	22.84	100
1923-24.....	59.63	17.82	22.55	100

## SUMMARY

1. The desire of the Columbia school board in 1904 to get rid of wasteful duplication of work in the eighth grade was based on a sound educational principle. In actual practice, however, this device has apparently not saved time for the pupils of Columbia as the board believed it would.

2. The Survey Committee believes that the action of the present school board looking toward the establishment of a junior high school consisting of grades seven, eight and nine represents a better solution of the problem than the action taken in 1904.

3. The Committee approves the junior high school organization because

- (a) It will make possible a wider range of courses than are now open to students in the seventh and eighth grades. This wider range of courses may be expected to make a stronger appeal than the traditional, rather narrow, seventh and eighth grade curriculum, and will enable pupils to try themselves out in such a way as to discover their peculiar educational and vocational aptitudes.
- (b) Considering the variety and quality of work, the junior high school organization is probably more economical than the 8-4 plan of school organization.
- (c) By grouping the junior high school pupils together, it is possible to deal in a more satisfactory way with the special social and disciplinary problems of early adolescence.
- (d) By grouping the junior high school pupils together, it is possible to have more specialization among teachers, and consequently, a better type of instruction.

4. It is, therefore, recommended that as soon as building facilities become available, the seventh, eight, and ninth grade pupils be brought into one building and that they be organized, administered and instructed as a junior high school group. This would leave the elementary schools with the first six grades, as at present and would leave grades 10, 11, and 12 to be organized as a senior high school group.

## CHAPTER III.

## THE PROBABLE FUTURE ENROLLMENT

Before presenting in detail any recommendations for a specific building program it is necessary to examine the facts that bear on the number of pupils in each school division who will likely have to be accommodated during the next two decades. This period of time is chosen because when permanent fireproof buildings are planned and constructed they must be utilized for a long period of time. It is chosen also because only by looking several years ahead is it possible to develop a school building plan which will take care of the growth of the city as it comes and at the same time furnish well constructed and properly located school buildings. It is, therefore, the purpose of this chapter to present some facts bearing on the probable number of school children in each school division for whom provision will likely have to be made during the next two decades.

In 1890 the population of Columbia was 4,000, of which approximately fifty per cent was colored. By 1900 the population had increased to 5,615, an increase of 41 per cent. In 1910 the population was 9,622, which represented an increase of 71 per cent over the ten-year period. The 1920 census showed a population of 10,392, an increase of 7.6 per cent over that of 1910. In 1920 the negroes numbered 1919 or 18.4 per cent of the total population. The negro population has remained practically constant during the three decades from 1890 to 1920 except that between 1910 and 1920 there was a decrease. In Table XII is a comparison of the trend of the population growth in Missouri and Columbia during the period from 1900 to 1920. In 1900 the State's population increased by 16 per cent over that shown by the 1890 census,

TABLE XII.  
COMPARISON OF TREND OF POPULATION GROWTH IN MISSOURI  
AND  
THE CITY OF COLUMBIA OVER A PERIOD OF YEARS.

Year	Population	Increase Over Previous Number	Per Cent.
1920 Missouri.....	3,404,055	110,720	3.4
1920 Columbia.....	10,392	720	7.6
1910 Missouri.....	3,293,335	186,670	6.0
1910 Columbia.....	9,662	4,011	71.0
1900 Missouri.....	3,106,665	427,481	16.0
1900 Columbia.....	5,651	1,651	41.3

This table shows a very rapid growth in the population of Columbia in the two decades from 1890 to 1910, and a substantial increase from 1910 to 1920.



whereas the gain for Columbia was 41 per cent. From 1900 to 1910 Missouri gained 6 per cent, while Columbia gained 71 per cent. From 1910 to 1920 the population of the State increased by only 3.4 per cent as compared for an increase of 7.5 per cent for Columbia. While the increase was much more rapid in the two decades between 1890 to 1910, there has been a substantial growth over the entire period.

Columbia has been a rapidly growing city during the past three decades and from the point of view of this survey this is a very significant fact because if the causes that brought about this increase continue to operate, the school building program for the future must take into account the fact that many additional pupils must be provided for. In a city where the population is not increasing there is not so much reason for a forward looking school building program but in a rapidly growing city such a plan becomes almost imperative.

TABLE XIII.  
ENROLLMENT IN THE UNIVERSITY OF MISSOURI  
1860 TO 1924.

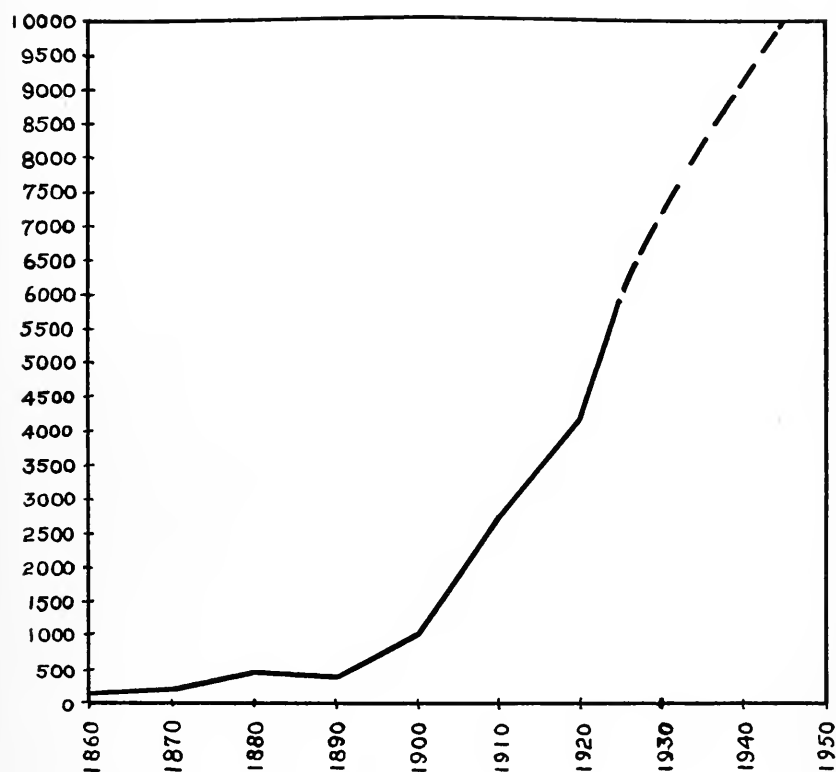
Year	Enrollment	Year	Enrollment
1860	140	1893	600
1861	169	1894	517
1862	64	1895	519
1863	-----	1896	681
1864	121	1897	701
1865	-----	1898	701
1866	104	1899	815
1867	87	1900	1038
1868	129	1901	1304
1869	144	1902	1479
1870	204	1903	1455
1871	217	1904	1616
1872	294	1905	1857
1873	407	1906	2082
1874	401	1907	2307
1875	390	1908	2601
1876	321	1909	2672
1877	399	1910	2741
1878	418	1911	2749
1879	444	1912	2917
1880	484	1913	3081
1881	558	1914	3397
1882	509	1915	3563
1883	491	1916	4082
1884	502	1917	4263
1885	459	1918	3134
1886	454	1919	3259
1887	530	1920	4222
1888	573	1921	4921
1889	580	1922	5170
1890	428	1923	5655
1891	487	1924	5890
1892	631	-----	-----

In attempting to make some estimate of the future growth of Columbia it is well to consider some of the factors that will doubtless influence her growth. First of all the future growth of Columbia will doubtless depend to some extent on the degree to which its citizens show interest and skill in the development of trade, and in attracting manufacturing and industrial enterprises. It is probable that this factor alone would bring about some growth. A second factor in the future growth is the extent to which the State University grows and attracts people who come to Columbia for educational reasons or to supply the wants of those who do. The future of the University of course depends on the extent to which it is given financial support by the people of the State. It depends too on the extent to which it meets the popular demands for the various kinds of higher education that the people of a democracy seem likely to desire in the immediate future. On the basis of a study of the history of the University during the past three or four decades, it seems entirely reasonable to assume that it will continue to enlarge its scope so as to give advanced training to a larger and larger percentage of the population and that the State will come to support it more and more adequately not only as an institution for training professional men and women, but as an institution that renders an indispensable service to the State through its researches and its many types of public service. This hopeful view of the future of the State University is based in part on consideration of its growth in the past. The enrollment figures presented in Table XIII show that up to 1890 its growth was quite nominal. It did not at that time have as many students as are now enrolled in the last three years of the Columbia High School. From 1890 to 1900 the attendance at the University more than doubled and the population of Columbia increased by more than 40 per cent. From 1900 to 1910 the University attendance almost trebled and the population of Columbia increased by 70 per cent. Due to the World War and accompanying conditions the University attendance did not increase so rapidly during the decade between 1910 and 1920 and there was a slowing up of the rate of increase of the population of the city. Since 1920 the enrollment of the University has been increasing rapidly. In the first four years of this decade the attendance has increased by a greater amount than in the entire period from 1910 to 1920. This increase in attendance at the State University is no mere accident. It closely parallels a nation-wide development of a demand for higher education. In 1889-1890 the public high schools of Missouri enrolled about 6,000 students.<sup>1</sup> In 1909 the number was about 35,000. In 1923-24 there were more than 90,000 students in the public high schools of the State. The percentage increase of secondary students has continued high from year to year and will

probably continue high for many years. This rapid increase in the number of secondary school students provides a source from which the University must almost inevitably draw larger and larger numbers. Taking the trend of increase over the past few decades as a basis, it seems reasonable to estimate, as shown in Chart 2, that the University will enroll eleven or twelve thousand students by 1945. If such an increase comes in the University enrollment there must of necessity be a decided increase in the population of the city of Columbia.

CHART 2.

TREND OF THE GROWTH OF THE UNIVERSITY OF MISSOURI  
1860 TO 1924 AND AN ESTIMATE FROM 1924 TO 1945.



Closely connected with this factor of the growth of the University is a possible very remarkable development of transportation facilities. Columbia has had her growth in the past in spite of unfavorable facilities for travel and transportation. The construction of two state highways

which cross at Columbia and the probable development of motor transportation beyond anything which seems possible at present will make Columbia one of the most accessible and conveniently located towns in the State. This will serve not only to make the University more accessible to students but will stimulate trade and industries of many kinds.

In addition to the students who attend the University the Junior College students constitute a very appreciable factor in estimating the future population of the city. The enrollment in the two junior colleges more than trebled during the period between 1912 and 1924. Table XIV which combines the University enrollment with that of the two junior colleges makes a very effective presentation of the rapidity of the increase of college students in Columbia.

TABLE XIV.

ENROLLMENT IN THE UNIVERSITY OF MISSOURI AND THE TWO JUNIOR COLLEGES IN COLUMBIA, 1912-13 TO 1923-24.

Year	University of Missouri	The Two Junior Colleges	Total
1912-13	3,081	207	3,288
1913-14	3,397	313	3,710
1914-15	3,563	283	3,846
1915-16	4,082	355	4,437
1916-17	4,263	374	4,637
1917-18	3,134	433	3,567
1918-19	3,259	484	3,743
1919-20	4,222	584	4,806
1920-21	4,921	659	5,580
1921-22	5,170	527	5,697
1922-23	5,655	680	6,335
1923-24	5,890	714	6,604

This table shows the increase in enrollment in the University and the two Junior Colleges. Note that from 1912 to 1924 the total enrollment in the three institutions more than doubled.

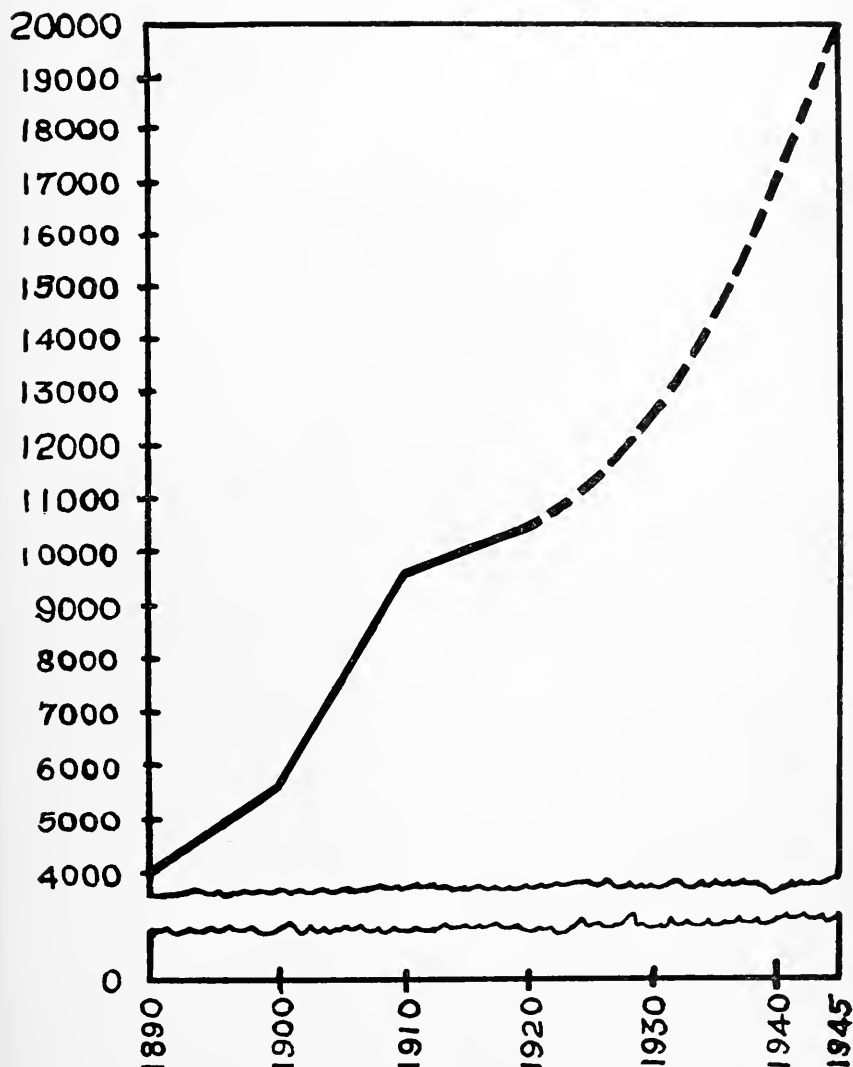
There are undoubtedly numerous other factors that may affect the growth of population in Columbia such as the desirability of the city for residential purposes and the possibility of new transportation lines, but those mentioned seem to afford a sufficient basis for expecting a substantial and fairly rapid increase in the population of Columbia during the next two decades. Using the trend of population in the past together with the foregoing considerations it is estimated that the population of Columbia will be at least 20,000 by 1945. This estimate is shown graphically in Chart 3.

Without going into any elaborate statistical computations the Survey Committee estimates that by 1945 there will be approximately 2,200 white pupils in grades 1 to 6, about 850 junior high school pupils in grades 7, 8, and 9, and about 750 senior high school pupils coming

from within the school district. It is possible that the number of pupils of senior high school grades attending from outside the district may

CHART 3.

TREND OF POPULATION IN COLUMBIA FROM 1890 TO 1920  
AS SHOWN BY THE UNITED STATES CENSUS REPORTS,  
AND ESTIMATED TREND FROM 1920 TO 1945.



bring the number actually enrolled in the senior high school to 1,000 students by the end of the period under consideration. The statistical information on which these estimates are made appear in the appendix, but there are many factors which make necessary the use of judgment as well as statistical information in making these estimates. All that is claimed for the foregoing estimates is that they represent the best guess which the survey committee could make after a consideration of all available facts. It is necessary to make some such estimate because any building constructed now must include either in present construction or in definite plans for enlargement sufficient accommodations for those who must be served for at least 20 years. On the basis of these estimates five elementary schools with accommodations for about 550 pupils each would be required by 1945. Because of the fact that Columbia appears to be growing in every elementary school area it is difficult to make any reasonable estimates of the probable enrollment of any given elementary school at any particular period.

Tables XV and XVI show respectively the population increase by wards, and the trend of enrollment by buildings. While wards 3 and 4 which are served by the Lee and Grant Schools show the largest percentage of increase the trend of enrollment in the other elementary schools apparently show that since 1920, at any rate, the white population in wards 1 and 2 has been increasing. The only recommendation that seems warranted on the basis of these facts is that when any new elementary school building is constructed to replace any one of the five it be so planned as to make possible addition for an ultimate capacity of 600 pupils. The playgrounds provided, the gymnasium-auditorium, the administrative suite, heating plant and all special rooms should be planned so as to provide for a possible maximum of 600 pupils. If this is done it will be necessary to provide only a sufficient margin of actual classroom space to take care of two or three years of increase. Additional classrooms may then be provided as needed.

TABLE XV.  
POPULATION INCREASE IN COLUMBIA, MISSOURI.

By Wards  
(From 1910 to 1920)

Ward No.	Population 1910	Population 1920	Increase	Per Cent of Increase
(Ward I) .....	4,014	4,318	304	7.57
(Ward II) .....	2,259	1,895	-364	-16.00
(Ward III) .....	1,567	1,690	123	7.8
(Ward IV) .....	1,822	2,489	667	36.6
Total .....	9,662	10,392	730	7.5

TABLE XVI.

## WHITE ENROLLMENT BY ELEMENTARY SCHOOLS 1915-1924.

Year	Name of School						Total
	Ridgeway	Benton	Field	Grant	Jefferson	Lee	
1915-16-----	-----	263	-----	279	473	202	1,217
1916-17-----	-----	255	-----	265	362	208	1,090
1917-18-----	-----	256	-----	302	516	223	1,297
1918-19-----	-----	208	130	195	266	197	996
1919-20-----	-----	236	144	232	340	239	1,191
1920-21-----	-----	266	291	249	318	264	1,288
1921-22-----	-----	283	255	258	344	263	1,403
1922-23-----	-----	298	255	278	349	277	1,457
1923-24-----	*302 (1-6)	*286 (1-6)	*266 (1-6)	*223 (1-6)	*186 (7)	*242 (1-6)	1,505

\*Indicates grades in each school when different from 1-7. This table indicates the enrollment for the respective grade school districts from the year 1915-16 to 1923-24. In interpreting this table it must be remembered that district areas have not been kept constant.

It will probably be several years under the present plan before the junior high school is fully developed. It is therefore believed that for the next ten years the present senior high school building will accommodate all the junior high school pupils in Columbia. Sometimes during the latter part of the second decade it will probably be necessary to provide additional shops and classrooms at this building for junior high school purposes.

On the basis of the estimates of this chapter it is believed that the laboratories, shops, storerooms, gymnasium, auditorium, cafeteria and other special features of the proposed senior high school should be planned for an estimated enrollment of at least 1000 students and that in the first construction a sufficient number of classrooms be provided to accommodate 650 students. The plans should include definite provision for the addition of classrooms as they are needed so as to provide for at least a thousand senior high school students.

It would probably be wisest to organize the school for colored children on a 6-6 basis instead of 6-3-3 plan, because owing to the small number of pupils it would be more economical and educationally more desirable to continue to house them in one building. It is estimated that during the period under consideration provision will need to be made for a maximum of approximately 350 colored pupils in grades 1 to 6 and approximately 250 above the sixth grade. To accommodate these pupils it is recommended in another chapter that an addition be made to the present building providing gymnasium-auditorium, shop and additional classroom space.

## SUMMARY

1. A consideration of the trend of population in Columbia in the past and the factors that influence her growth seem to warrant an estimate of at least 20,000 population by 1945.
2. On the basis of this estimate and a consideration of the educational plans for Columbia it is believed that there will be approximately 1000 senior high school students in Columbia by 1945.
3. It is recommended that the immediate construction of a senior high school provide all special features on the basis of an enrollment of 1000 and that a sufficient number of classrooms be provided for 650 students. The plans should provide for the construction of additional classrooms as they may be needed.
4. It is believed that the present high school building will care for all junior high school pupils of Columbia for at least ten years. After that time some additional classrooms may be needed.
5. It is recommended that all elementary schools constructed to replace present buildings be provided with playgrounds and special features so as to ultimately accommodate 600 pupils. It is recommended that the first construction in each case include all the special features and a sufficient number of classrooms to allow for two or three years growth. Definite provision for additional classrooms should be included in the original plans.
6. It is believed that the enrollment of colored pupils will not exceed 350 in grades 1 to 6 and 250 in the grades above the sixth during the period considered. It is recommended that the required additional accommodations be furnished by making an addition or additions to the present building.



## CHAPTER IV.

### THE PROGRAM RECOMMENDED.

It was pointed out in Chapter I that the elementary pupils in grades one to six were housed in five elementary school buildings, that the seventh grade occupied an old elementary school building, and that the ninth, tenth, eleventh, and twelfth grades were housed in the high school building. It was also pointed out that all the colored children of Columbia, elementary as well as high school, were housed in the Fred Douglas School. It was further shown in this chapter that the poorest school building in the city was the one in which the seventh grade is now housed. Of the elementary schools, the Benton scored lowest and undoubtedly belongs in a program of replacement to be undertaken as soon as it becomes financially possible. While the Robert E. Lee is somewhat better than the Benton school, it also should be scheduled for replacement within the next few years. It is not a modern building in any sense and contains practically none of the special features that modern elementary school buildings should provide.

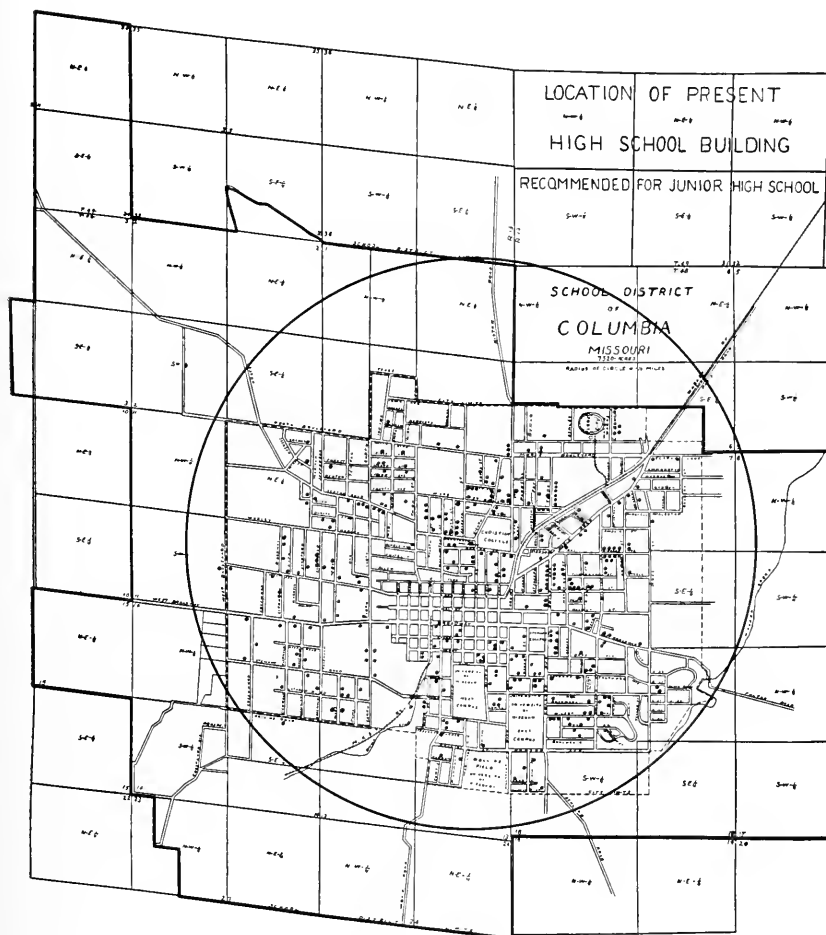
Facts were presented in Chapter III to show that Columbia has been, during the past three decades a very rapidly growing city, and that there is every indication that this growth will be perhaps even more rapid during the next two decades. It is entirely possible that the next twenty years will see almost one hundred per cent increase in the population of Columbia, and that by 1945 the city will have at least twenty thousand inhabitants. Since this is probable any building program undertaken must look well into the future and must, during the next twenty years, probably make possible provision for almost double the number of children who now attend the public schools of Columbia.

In Chapter II it was pointed out that Columbia has just started to make provision for the Junior High School grades, and the recommendation was made that very much more adequate provision be made for this important period in the educational lives of boys and girls than has been made in the past. Because of the reasons set forth in this chapter, and because of the fact that the present beginning of the Junior High School is housed in the poorest school building in the city, it is recommended that the first part of the building program adopted in Columbia make provision for the Junior High School grades. The survey staff has considered very carefully the best way in which this provision might be made. After due consideration of all the facts it is recommended that the present high school building be taken over for a junior high school plant, and that a new building be constructed for a senior high school. In

Chapter I attention was called to the fact that the present high school building is not well adapted to the needs of modern senior high school instruction. In addition to being poorly adapted for the purpose for which it is now being used, the high school building is not large enough to take care of the present high school population. Every citizen of Columbia is familiar with the fact that it has been necessary to have half day sessions at the high school which makes possible only one-half of the use of the building facilities to which the students should be entitled. While this measure is the only one that could be taken under present conditions, it is the opinion of the Survey Staff that it very materially reduces the effectiveness of high school instruction. It is not merely lack of space, however, that makes the present high school building poorly adapted to the purposes of modern high school instruction. It has inadequate laboratory space, inadequate space for shops, an inadequate auditorium, and a gymnasium that is little better than a mere makeshift. Moreover, it is located on a site which is certainly not more than one-third or one-fourth as large as an adequate high school site should be. After a careful examination of this building, the Survey Staff believes that it would be very much better adapted to the needs of junior high school instruction than it could ever be for senior high school instruction without the expenditure of an unreasonable amount of money. It is, therefore, recommended that the senior high school be taken over for a junior high school, and that a new senior high school building be immediately constructed. Map number 1 shows the location of the present junior high school pupils of the Columbia school district. On this map a circle is drawn with a one and one-half mile radius around the present high school building. It may be observed that every junior high school pupil in the district is included within this circle. A distance of one and one-half mile is not at all unreasonable for junior high school pupils to walk. It is, therefore, believed that this location is an ideal one for junior high school pupils of Columbia.

If the senior high school building then is to be erected as a first step in the school building program recommended for Columbia, it is important to choose an adequate site. After careful consideration of all available sites in Columbia, the Survey Staff believes that the most desirable location from every point of view is the tract of land known as the "Fair Grounds". It contains forty acres, and the Survey Staff recommends that the entire tract be purchased as a site for the senior high school building. In addition to being a beautiful tract of land with many shade trees, well drained, and occupying a very commanding position with respect to location in the city, it has a running track already laid out which could not be duplicated on any other available site

## MAP NUMBER 1.

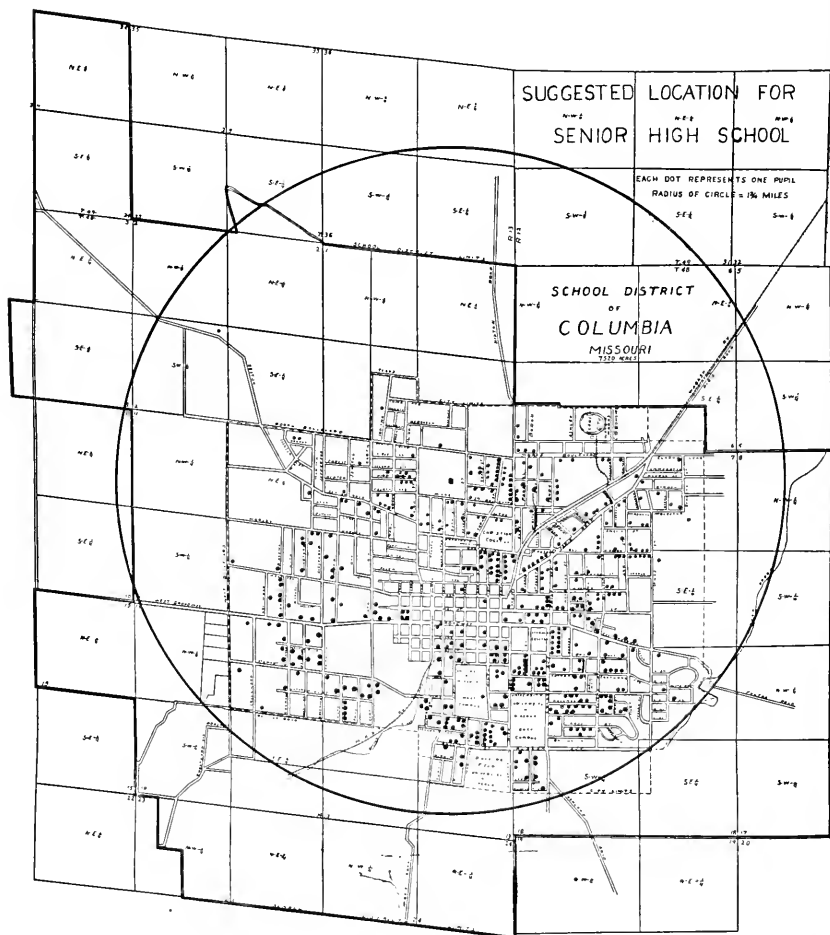
DESIRABILITY OF PRESENT HIGH SCHOOL BUILDING AS  
A LOCATION FOR A JUNIOR HIGH SCHOOL.

The dots on this map represent pupils in grades 7, 8 and 9, who would constitute the junior high school group under the plan recommended. All these pupils live within a mile and a half of the present high school site. This map shows that this is almost an ideal location for a junior high school.

without an expenditure of several thousand dollars. This site would make possible provision for all kinds of outdoor games; it would provide plenty of parking space for those who attend athletic events or school

## MAP NUMBER 2.

### THE FAIR GROUND TRACT AS A LOCATION FOR A SENIOR HIGH SCHOOL BUILDING.



Each dot on this map represents the approximate location of a senior high school pupil. The circle drawn about the proposed location for a senior high school has a radius of a mile and three quarters. It includes all the senior high school students, showing that the element of distance to be travelled by the students does not prevent the favorable consideration of this site.

exercises of any kind at the high school. Turned into a high school site this tract of land would be an exceptionally fine asset to the city of Columbia. It would virtually become a combination park and playground for all the citizens. Inasmuch as it is located on the State Highway, it would aid in creating an exceptionally favorable impression of the city on all those who passed along the highway.

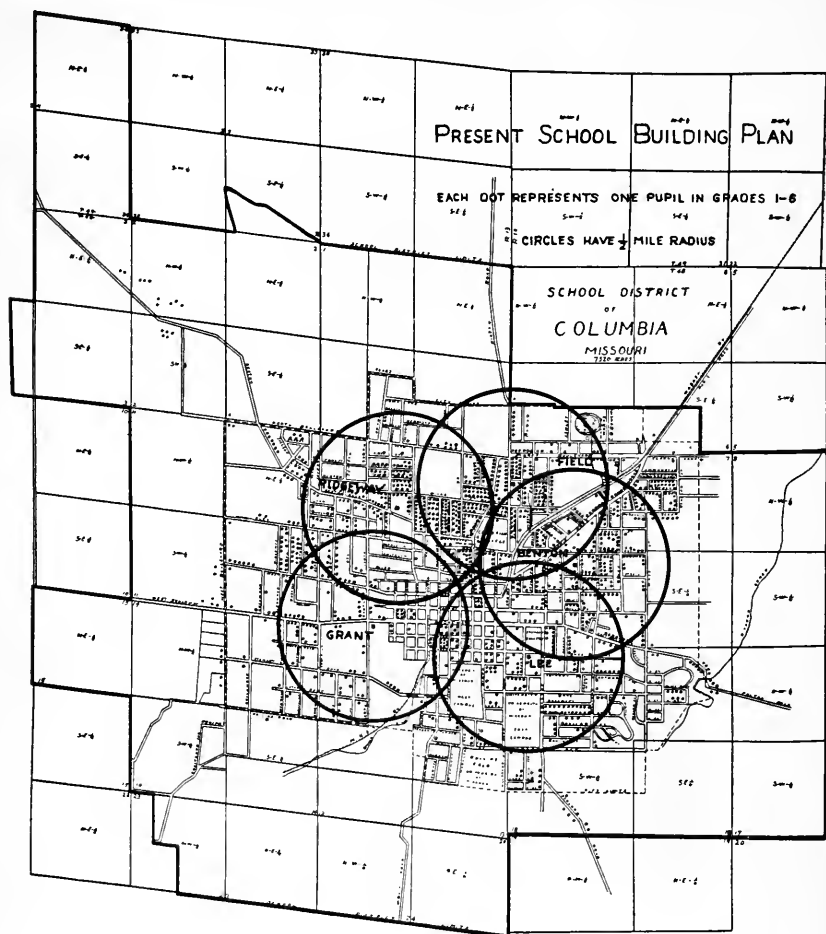
On first thought, it may seem to the average citizen of Columbia that this site is located too far to the north, and that it would be desirable to have a more central location. Map number 2 shows the distribution of the senior high school pupils in Columbia; that is, those in grades ten, eleven, and twelve who would be expected to attend school in this building. The circle drawn about the proposed site has a radius of one and three-quarter miles, which is not an unreasonable distance for a senior high school pupil to walk to school. Every senior high school pupil in the city is included in this circle so that this particular location is not undesirable because of lack of accessibility. A glance at the map will show that this location is not so far from the center of the school district as one might imagine. With respect to the eastern and western boundaries, it is almost an ideal location so far as centrality is concerned. The Survey Committee, therefore, strongly recommends that the "Fair Grounds" tract be purchased as a site for a senior high school building, and that the first school building constructed in the program be the senior high school building.

The construction of a new senior high school building should be followed as soon as financially possible by the construction of a new Benton elementary school and an addition to the Douglas school building for colored children. It is recommended that by about 1930 steps be taken to replace the Lee school building and that the replacement of the Grant building be planned for about 1935.

Because of the fact that the population of Columbia seems practically certain to increase very decidedly during the next two decades in the areas served by the Benton, Lee and Grant elementary schools, it is recommended that at the time of replacement each of these buildings be located further from the center of the town. A glance at map number 3 shows the extent to which the area served by each of these schools overlaps that of other school building areas. The two blocks north of Hinkson avenue and East of Ann street would provide an exceptionally fine location for the Benton school, and suitable grounds could be secured for the Lee school approximately a quarter of a mile to the southeast of its present site. It would still be possible to acquire a site for relocating the Grant school whenever it becomes necessary to replace it about a

## MAP NUMBER 3.

## LOCATION OF PRESENT ELEMENTARY SCHOOL BUILDINGS.

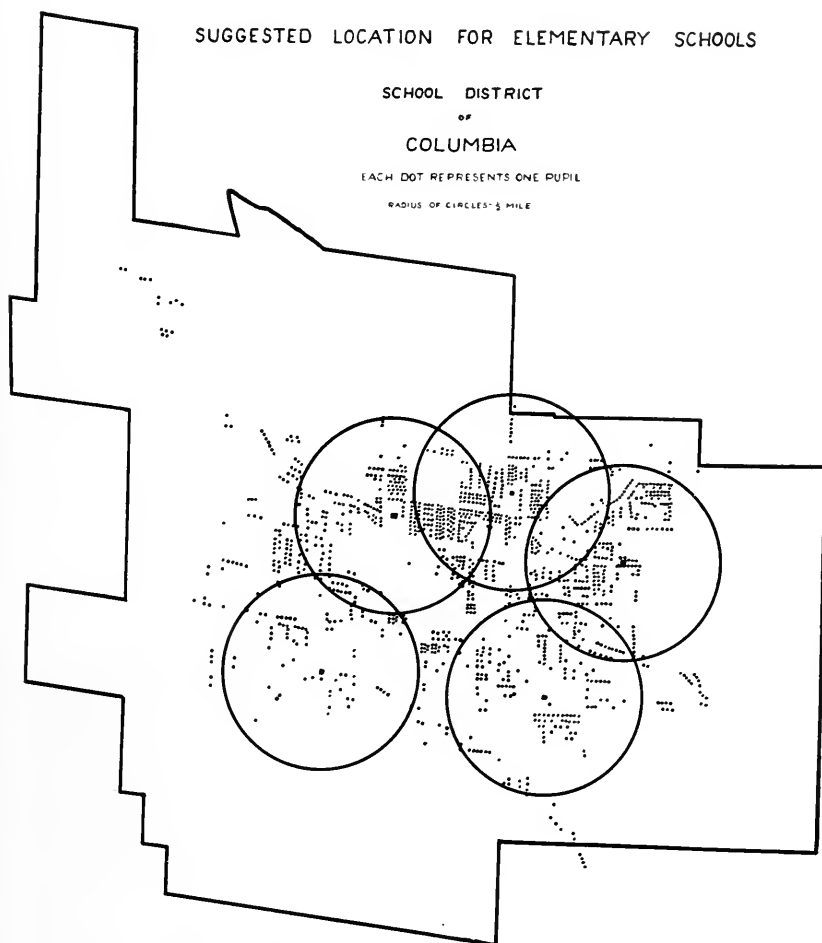


This map shows the excessive over-lapping of elementary school areas. It suggests the desirability of choosing new sites for the Benton, Lee and Grant schools so that when they are replaced they will be more conveniently located for population increases in the northeast, southeast and southwest portions of the city.

quarter of a mile southwest of its present site. Map number 4 shows the elementary school areas as they would be if the Benton, Lee and Grant schools were relocated as here recommended. Under the present plan 239 elementary school pupils live outside the circles drawn with half

## MAP NUMBER 4.

## THE LOCATIONS RECOMMENDED FOR THE ELEMENTARY SCHOOLS OF COLUMBIA.



Under the plan recommended the Bention school would be located to the northeast of its present site; the Lee school to the southeast of its present site and the Grant school to the southwest of its present location. It is believed that such locations would be more reasonable and more convenient in the light of the probable future growth of Columbia. At some time in the future the board will have to decide between building a new elementary school building north of Broadway and west of the Ridgeway school and building a larger Ridgeway school building further west. No recommendation is here made on this point because such a decision should probably await further population development in the northwestern portion of the city.

mile radii about the elementary school buildings. Under the proposed location only 204 of the present white elementary school population would be more than a half mile from a school building. This fact is shown quite clearly in map number 4. As the population of the city continues to increase, the greater convenience of the proposed new locations will become more and more apparent.

The Committee does not recommend that the Grant school be abandoned for school purposes until it has been used through its natural period of usefulness. The building is not of expensive construction and has many faults and will probably not be very desirable for school purposes after 1935. It is not believed that this building is worth modernizing or adding to. It would probably cost as much to modernize and add to it as it would to erect a new building. It is, therefore, recommended that when additional school facilities become necessary in the Grant school area a new building be begun on a site about a quarter of a mile to the southwest of the present location and that the first unit of the new Grant school be constructed large enough to accommodate the immediate number of surplus pupils and to provide for three or four years of increase. Whenever the present Grant school building has to be abandoned the remaining units of the proposed new Grant building could be added.

No mention has so far been made of the problem of taking care of the future school population increase in the Field and Ridgeway elementary school areas. It is recommended that when the Benton and Grant schools are replaced the buildings be made sufficiently large to take care of some of the pupils in the Field and Ridgeway areas. But at some time during the period covered by this report it will be necessary to in some way add to the facilities now available at each of these buildings. It is estimated that by 1935 an addition will have to be provided for the Field building. This addition should include a combined gymnasium-auditorium, lunch room, nurses' room, administrative suite, library, shower baths, etc. This building is so well constructed that it promises to be satisfactory for many years. The Committee believes that it will be wise and economical to add to this building. The Ridgeway does not present such a simple case. A study of map number 3 shows that with the increase of population in northwest Columbia this building is not within a half mile of a large number of pupils. The same map shows that the Ridgeway area overlaps that of the Field school. In other words, it seems apparent now that this building should have been located further to the west. But the building is new, and although it is not a first rate school building it will be useable for many years. In addition to having some defects of arrangement this building is so constructed that it would be very difficult to add to it in any satisfactory manner. It would, there-



fore, probably be wise to plan the ultimate relocation of this building on a site about 2-5 of a mile to the west. Following this recommendation would mean that no further additions would be made to this building but that at some time in the future a site located as suggested would be purchased. Whenever it becomes necessary to have extensive additional facilities for the Ridgeway area the first unit of a school building should be erected on the proposed new site. This building should be so planned that it could be added to from time to time so as to provide for at least 600 pupils. When the present Ridgeway building is abandoned (which will of course be beyond the 20 year period covered by the recommendations of this report) all the pupils of Ridegway area would be accommodated in the proposed new building. Such a plan would make the ultimate number of elementary school buildings five instead of six. It is believed that the beginning of this building might be delayed until 1940 by adopting the means already suggested, with perhaps the utilization of temporary or portable classrooms during a few years.

There are many factors that enter into the problem of estimating the probable cost of the program sketched in this chapter. Such an estimate would require long and careful study by a competent school architect. In order to get some definite basis for action, however, the Committee has estimated as carefully as could be done without the services of an architect the probable cost of the program. Before any bond issue is submitted, it is recommended that the board secure the services of an expert school architect in order to be more exactly informed of the cost of any proposed buildings or improvements.

### SUGGESTED PLAN.

1. Submit a 30 cent building tax at the April, 1925 election for the purpose of purchasing new school sites and making additions to present sites.

2. Use the \$40,000 now available in the sinking fund to retire that amount of outstanding school bonds. This would make it possible to bond the city for \$400,000.00.

3. Submit to the voters a proposition to bond the city for that amount, the issue to be 20-year serial bonds. Use this money for the following purposes:

- |    |  |           |
|----|--|-----------|
| a. | Construction and equipment of first unit of senior high school building..... | \$290,000 |
| b. | Addition to Douglas School.....  | 30,000    |
| c. | Construction of Benton Elementary School.....                                | 80,000    |

Total....	.....	\$400,000
-----------	-------	-----------

4. By about 1930 replace the Lee School (estimated cost \$80,000) and make an \$80,000 addition to the new senior high school building recommended in number 3<sup>1</sup>.

5. By about 1935 replace the Grant school, (estimated cost \$80,000).

6. Take care of the increase in the Field and Ridgeway schools as long as possible by building the Benton and Grant somewhat larger than immediate needs warrant and by utilizing temporarily spare classrooms in the proposed junior and senior high schools.

7. Sometime after 1935 add to the Field school, (estimated cost \$50,000).

8. At some time in the future either purchase a site for a new school building in northwest Columbia, to the west of the Ridgeway, or preferably buy a site to which the Ridgeway school will be moved when the present building needs to be abandoned. The abandonment of this building would, of course, be beyond the period of 20 years covered in this report; but the beginning of the building to replace the Ridgeway could be made when the classroom space becomes necessary and this new building could be enlarged as might be necessary whenever the Ridgeway building becomes old and has to be abandoned. A site located about 2-5 of a mile to the west of the present Ridgeway building would afford a location convenient to the northwestern portion of the district, and a single building developed there would doubtless be sufficient for many decades. (Estimated cost in 1940 \$55,000.)

### SUMMARY

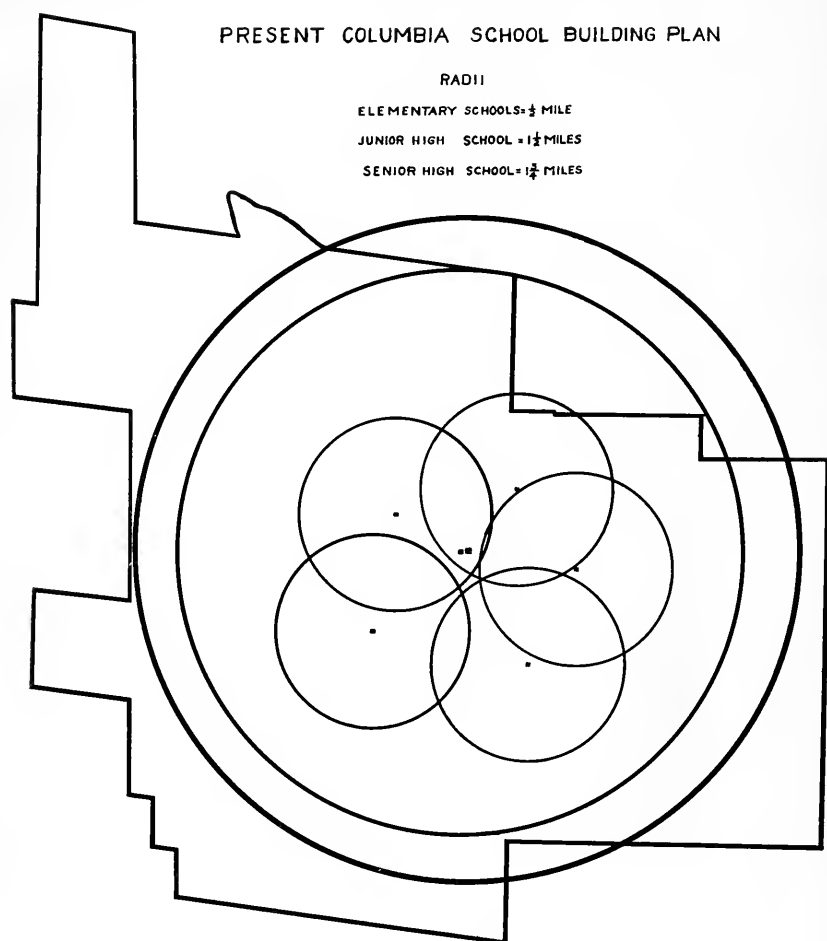
1. The Committee believes that the most pressing school building need in Columbia is immediate provision for white junior and senior high school students. It recommends that this provision be made by taking the present high school building for a junior high school and by purchasing the "Fair Grounds" tract and constructing thereon a new senior high school building. It is recommended that the purchase of this site and the construction of a high school building be made the first step in the Columbia high school program.

(1) If the board wishes to delay the submission of the bond issue as late as October 1, 1925, an additional \$50,000 could be voted which would make possible the construction of a senior high school building that would probably accommodate all the pupils who would attend for the next two decades. If this were done the \$80,000 bond issue for an addition to the high school building would not be required in 1930.

2. It is recommended that the second phase of the school building program attempted in Columbia be the construction of a Benton elementary school and the addition of auditorium, gymnasium, and shop facilities at the Douglas school for colored pupils.
3. It is recommended that the third phase of the program be the construction of a new elementary school to replace the Robert E. Lee school on a site to the southeast of its present location.
4. It is recommended that the fourth step be the construction of a new elementary school building to replace the Grant, on a location to the south and west of the present site.
5. Additional facilities will probably need to be provided at some time during the period considered for both the Field and Ridgeway elementary schools. The Field school seems well located and it is recommended that the playground be enlarged and the building added to. The Ridgeway seems to be improperly located and it is recommended that a new location be considered at such time as the population trend in northwest Columbia becomes more clearly established.

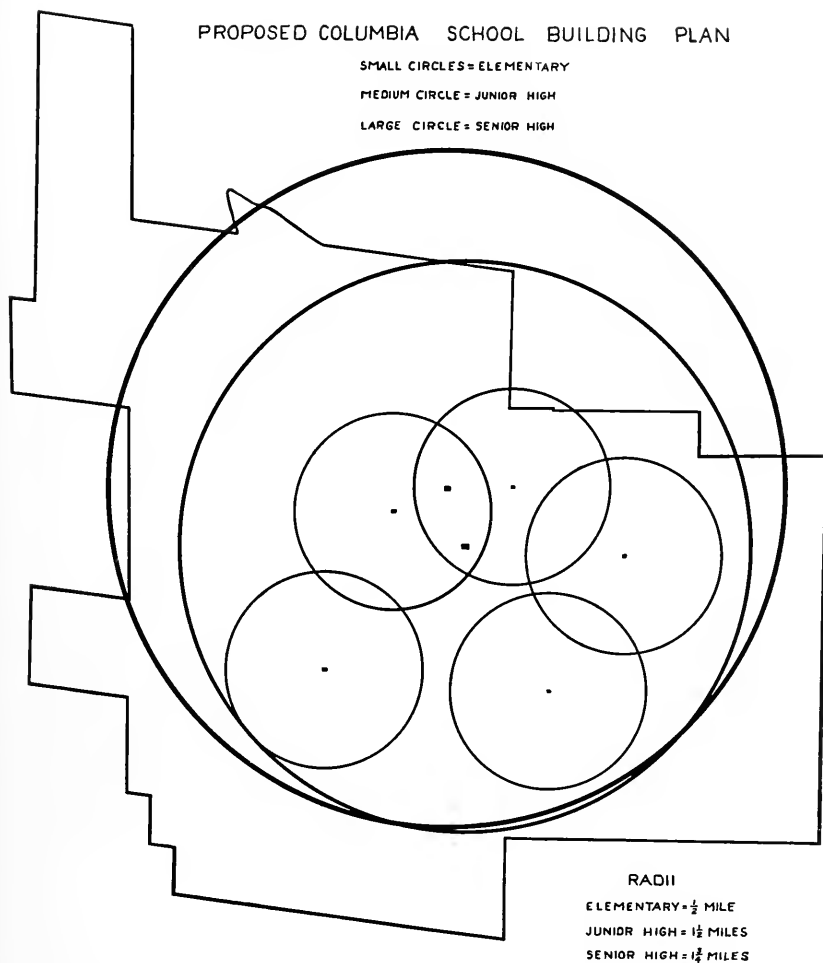
## MAP NUMBER 5.

## THE PRESENT SCHOOL BUILDING PLAN FOR WHITE PUPILS.



The chief suggestion contained in this map is that the elementary school areas overlap more than is desirable and that future constructions should be made on sites located so as to care for the population growth in the outlying sections of the city.

# MAP NUMBER 6. THE PROPOSED PLAN.



This map shows that the suggested re-location of the Benton, Lee and Grant schools at such times as it becomes necessary to replace them would provide better for future population growth. It shows also that the senior high school site recommended is not unreasonable so far as centrality of location is concerned.

## CHAPTER V

## FINANCING THE BOND ISSUE.

In the previous chapter a building program was suggested for the city of Columbia and a definite plan was proposed for securing the buildings and improvements recommended. It was advised that the services of a competent school architect be secured to check up on these plans so that the board might determine more exactly whether or not the estimated amounts would provide school buildings of high quality and with sufficient rooms to accommodate the probable number of students before submitting a bond issue to a vote of the people. It is the purpose of this chapter to show the amount of money that would need to be raised each year to provide for interest and sinking fund payments on present indebtedness and recommended future indebtedness. It will also be the purpose of this chapter to show whether or not Columbia is financially able to provide the buildings recommended and whether the burden of taxation necessary for carrying out the program would be unduly large as compared with that assumed by other Missouri cities.

## Present Indebtedness.

Before presenting the financial details of the plan, it is necessary to explain that the Columbia school district now has outstanding \$232,500 worth of sinking fund bonds due and payable as shown in Table XVII. There is now available in the sinking fund approximately \$40,000 which might be used on March 1, 1925 to retire the high school bonds described in the table. It is recommended that this action be taken so as to reduce the outstanding bonded indebtedness to \$192,500. The discussion of the following plan assumes that this payment will be made.

TABLE XVII.  
BONDS OUTSTANDING JANUARY 1925.

Issue	Date	Rate	Denomination	Serial No.	Amount	Redeemable	Due
H. S.-----	3/1/09	4%	1,000	41-90	40,000	3/1/24	3/1/29
Ward S.-----	3/1/09	4%	500	21-35	7,500	3/1/24	3/1/29
Gen. Imp.-----	6/1/16	4%	1,000	1-43	43,000	6/1/26	6/1/36
Gen. Imp.-----	6/1/16	4%	1,000	44-90	47,000	6/1/31	6/1/36
Gen. Imp.-----	3/1/22	5%	1,000	1-95	95,000	3/1/32	3/1/42
Total outstanding bonds-----						\$232,500.00.	
Amount in sinking fund (app.)-----						40,000.00.	
Total net indebtedness-----						192,500.00.	

## Serial Bonds Recommended For Future Issue.

The indebtedness by years under the proposed plan is shown in Table XVIII. The \$7,500, \$43,000, \$47,000 and \$95,000 bond issues

indicated in this table are sinking fund bond issues that now exist. The amounts remain constant up to the approximate dates for final payment, though of course, the sinking fund would be added to each year sufficiently to retire these three issues by the time of their maturity. The remaining issues are shown as decreasing from year to year. This is because the Committee recommends that all future bond issues be Serial Bonds instead of Sinking Fund Bonds, as in the past. Serial Bonds are simply bonds paid on the installment plan—that is by payments made at regular intervals. All the payments on principal may be equal, or smaller payments on the principal may be made at first, gradually increasing them as interest payments decrease, so as to make payments on both interest and principal amount to approximately the same amounts each year until the bonds are retired. In the description of the plan which follows, payments on serial bonds have been calculated according to this latter method. The enormous increase in the popularity of serial bond issues during recent years probably makes any lengthy comment on their advantages unnecessary. At least five states, Massachusetts, New Jersey, North Carolina, Wisconsin and Ohio now have laws requiring all school bond issues to be on serial payment basis. Perhaps the greatest advantage of serial over sinking fund bonds is that the annual payment of installments under the serial plan makes the payments sure and there is no possibility of failure to retire the bonds at maturity because of failure to provide a requisite sinking fund. The serial bond plan does away with the necessity of investing sinking fund money from year to year and does away with any possibility of loss from this source. Serial bonds have been recently issued in a number of Missouri cities among which are Marshall and Jefferson City.

### **The Plan Described.**

Under the proposed plan a \$400,000 bond issue would be submitted as soon as possible for the purpose of constructing the first unit of a senior high school building, replacing the Benton elementary school, and providing an auditorium, gymnasium, and shop facilities for the Douglas school. By 1931 it is estimated that an addition would be necessary to the first unit of the high school building,<sup>1</sup> and that it would be desirable to replace the Lee elementary school. For these purposes a bond issue for \$160,000 is recommended. The remainder of the program is set forth in the summary to Chapter IV.

(1) See footnote page 52. If the bond issue is delayed until Oct. 1, 1925 a bond issue of \$450,000 which would probably make possible the completion of the senior high school building under the first bond issue.

Table XVIII shows the indebtedness under each of the proposed bond issues by years, and Table XIX shows the possibility of providing for these bond issues with the estimated trend of assessed valuation in Columbia. The last column of Table XIX shows the estimated free bonding power of the city by years from 1926 to 1945 under the proposed plan. Inasmuch as the estimates of increases of assessed valuation have been made very conservatively, it is probable that under this plan the maximum bonding power would not be used in any year. At the close of the period the city would have a possible bonding power of \$655,000.

Table XX shows the payments by years on account of principal and interest and Table XXI shows the tax rate by years on the basis of these required payments and the estimated trend of assessed valuation. The tax rate for interest and sinking fund purposes would average about 40 cents on the one hundred dollars of assessed valuation and would, in no case, exceed 45 cents.

TABLE XVIII.  
INDEBTEDNESS BY PROJECTS UNDER PROPOSED PLAN

Year	7500 W. S. S. F. B.	90,000 G. Imp. S. F. B.	95,000 G. Imp. S. F. B.	*Prop. H. S. Benton Doug. Add. Ser. B.	*Prop. Lee and H. S. Add. Ser. B.	*Prop. Grant Serial Bonds	Prop. Field Serial Bonds.	Prop. Ridge- way Addi- tion Ser. B.	Total
1926-----	\$7,500	\$90,000	\$95,000	\$400,000	-----	-----	-----	-----	\$592,500
1927-----	7,500	90,000	95,000	388,000	-----	-----	-----	-----	580,500
1928-----	7,500	90,000	95,000	375,000	-----	-----	-----	-----	567,500
1929-----	7,500	90,000	95,000	361,000	-----	-----	-----	-----	553,500
1930-----	-----	90,000	95,000	346,000	-----	-----	-----	-----	531,000
1931-----	-----	90,000	95,000	331,000	\$160,000	-----	-----	-----	676,000
1932-----	-----	90,000	95,000	315,000	155,000	-----	-----	-----	655,000
1933-----	-----	90,000	95,000	298,000	150,000	-----	-----	-----	633,000
1934-----	-----	90,000	95,000	281,000	144,000	-----	-----	-----	610,000
1935-----	-----	90,000	95,000	263,000	138,000	-----	-----	-----	586,000
1936-----	-----	-----	95,000	244,000	132,000	\$80,000	\$50,000	-----	601,000
1937-----	-----	-----	95,000	224,000	126,000	78,000	48,000	-----	571,000
1938-----	-----	-----	95,000	203,000	119,000	75,000	46,000	-----	538,000
1939-----	-----	-----	95,000	182,000	112,000	72,000	44,000	-----	505,000
1940-----	-----	-----	95,000	159,000	105,000	69,000	42,000	-----	470,000
1941-----	-----	-----	95,000	136,000	97,000	66,000	40,000	\$50,000	484,000
1942-----	-----	-----	-----	111,000	89,000	63,000	38,000	48,000	349,000
1943-----	-----	-----	-----	85,000	81,000	60,000	36,000	46,000	308,000
1944-----	-----	-----	-----	58,000	72,000	57,000	34,000	44,000	265,000
1945-----	-----	-----	-----	30,000	63,000	32,000	53,000	42,000	220,000
Total Pymts. on Prin.-----	7,500	90,000	95,000	400,000	107,000	31,000	20,000	10,000	760,500
Balance To Pay After 1945-----	0	0	0	0	53,000	49,000	30,000	40,000	172,000



TABLE XIX.  
FREE BONDING POWER BY YEARS UNDER PROPOSED PLAN

Year	Estimated Valuation	Legal Bonding Limit	Total Gross Indebtedness	Free Bonding Power.
1926.....	\$13,000,000	650,000	592,500	57,500
1927.....	13,100,000	655,000	580,500	74,500
1928.....	13,200,000	660,000	567,500	92,500
1929.....	13,400,000	670,000	553,500	116,500
1930.....	13,600,000	680,000	531,000	149,000
1931.....	13,800,000	690,000	676,000	14,000
1932.....	14,000,000	700,000	655,000	45,000
1933.....	14,200,000	710,000	633,000	77,000
1934.....	14,400,000	720,000	610,000	110,000
1935.....	14,600,000	730,000	586,000	144,000
1936.....	14,800,000	740,000	601,000	139,000
1937.....	15,100,000	755,000	571,000	174,000
1938.....	15,400,000	770,000	538,000	232,000
1939.....	15,700,000	785,000	505,000	280,000
1940.....	16,000,000	800,000	470,000	330,000
1941.....	16,300,000	815,000	484,000	321,000
1942.....	16,600,000	830,000	349,000	481,000
1943.....	16,900,000	845,000	308,000	537,000
1944.....	17,200,000	860,000	265,000	595,000
1945.....	17,500,000	875,000	220,000	655,000

TABLE XXI.  
TAX RATE FOR INTEREST-SINKING FUND AND SERIAL PAYMENTS UNDER  
PROPOSED PLAN BASED ON ESTIMATED ASSESSED VALUATION.

Year	Estimated Assessed Valuation	Payments Required	Approximate Tax Rate In Cents Per Hundred Dollars.
1926.....	\$13,000,000	\$51,928	40
1927.....	13,100,000	52,388	40
1928.....	13,200,000	52,803	40
1929.....	13,400,000	53,173	40
1930.....	13,600,000	50,431	37
1931.....	13,800,000	62,956	46
1932.....	14,000,000	63,011	45
1933.....	14,200,000	63,021	44
1934.....	14,400,000	62,986	44
1935.....	14,600,000	62,906	43
1936.....	14,800,000	61,285	41
1937.....	15,100,000	62,945	42
1938.....	15,400,000	61,470	40
1939.....	15,700,000	61,995	39
1940.....	16,000,000	61,410	38
1941.....	16,300,000	65,820	40
1942.....	16,600,000	56,275	34
1943.....	16,900,000	56,450	33
1944.....	17,200,000	56,535	33
1945.....	17,500,000	57,530	33

TABLE XX.—YEARLY PAYMENTS ON INTEREST AND PRINCIPAL UNDER PROPOSED PLAN

	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935
7,500 Ward School Sinking Fund---	2,066.80	2,066.80	2,066.80	2,066.80	---	---	---	---	---	---
90,000 Gen. Imp. Sinking Fund---	11,096.19	11,096.19	11,096.19	11,096.19	11,096.19	11,096.19	11,096.19	11,096.19	11,096.19	11,096.19
95,000 Gen. Imp. Sinking Fund---	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64
Senior H. S., Benton and Doug. Serial Bonds-----	30,000.00	30,460.00	30,875.00	31,245.00	30,570.00	30,895.00	31,175.00	30,410.00	30,645.00	30,835.00
Lee and H. S. Add. Serial Bonds-----	---	---	---	---	---	12,200.00	11,975.00	12,750.00	12,480.00	12,210.00
Grant School Serial Bonds-----	---	---	---	---	---	---	---	---	---	---
Field School Serial Bonds-----	---	---	---	---	---	---	---	---	---	---
Ridgeway School Serial Bonds-----	---	---	---	---	---	---	---	---	---	---
TOTALS-----	51,928.63	52,388.63	52,803.63	53,173.63	50,431.83	62,956.83	63,011.83	63,021.83	62,986.83	62,906.83

At the end of this period Columbia would have an indebtedness for school purposes of only \$172,000.00 and an estimated bonding capacity of over six hundred thousand dollars.

TABLE XX.—YEARLY PAYMENTS ON INTEREST AND PRINCIPAL UNDER PROPOSED PLAN (CONTINUED)

	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
7,500 Ward School Sinking Fund										
90,000 Gen. Imp. Sinking Fund										
95,000 Gen. Imp. Sinking Fund										
8,765.64 Senior H. S., Benton and Doug. Add. Serial Bonds	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64	8,765.64				
30,980.00 Lee and H. S. Add. Serial Bonds	30,980.00	31,080.00	30,135.00	30,190.00	30,155.00	31,120.00	30,995.00	30,825.00	30,610.00	31,350.00
11,940.00 Grant School Serial Bonds	11,940.00	12,670.00	12,355.00	12,040.00	12,725.00	12,365.00	12,005.00	12,645.00	12,240.00	12,835.00*
5,600.00 Field School Serial Bonds	5,600.00	6,510.00	6,375.00	6,240.00	6,105.00	5,970.00	5,835.00	5,700.00	6,565.00	6,385.00**
4,000.00 Ridgeway School Serial Bonds	4,000.00	3,920.00	3,840.00	3,760.00	3,680.00	3,600.00	3,520.00	3,440.00	3,360.00	3,280.00***
61,285.64 TOTALS	61,285.64	62,945.64	61,470.64	61,995.00	61,430.64	65,820.64	65,275.00	66,450.00	66,535.00	67,530.00

\* 5 Payments after 1945 \*\* 10 Payments after 1945 \*\*\* 15 Payments after 1945

### **The Estimated Increase In Assessed Valuation.**

It has been mentioned that in order to estimate the future bonding power of the city and determine the possible tax rate for interest, sinking fund and serial bond payments it was necessary to make some calculation as to the probable trend of the assessed valuation of the school district. In the tables presented it was estimated that the present assessed valuation would increase \$100,000 a year during the next two years; that from 1928 to 1936 it would increase at the rate of \$200,000 a year and from that date to 1945 by \$300,000 a year. These estimates are no doubt far too conservative in the light of the increases of the past. For the ten years preceding the great increase due to the adoption of the so-called full valuation plan of assessment the average increase in assessed valuation was more than \$200,000 a year. With anything approximating full valuation the annual increase for the next twenty years should be at least twice that of the period from 1910 to 1920. It has averaged more than a \$400,000 a year increase since the valuation was practically doubled in 1920. Conservative estimates have been made because of a desire to show that the proposed building program could be financed with the minimum of expected increase in the valuation of the district. By 1945, if we may judge by the past, its valuation will probably be much nearer \$25,000,000 than the \$17,500,000 estimated in connection with the calculations of the preceding tables.

### **CAN COLUMBIA AFFORD THESE EXPENDITURES.**

What the inhabitants of any city can afford depends very largely on what they want most. Some relatively poor municipalities afford expensive school plants, superior equipment and highly trained teachers because they want good educational opportunities for their children so badly that they are willing to deny themselves the satisfaction of other wants. It is not, however, the purpose of this chapter to put the problem on any such basis because the citizens of Columbia have on many previous occasions demonstrated the extent of their belief in good educational opportunities. It is proposed here to put the question on a very much more practical and matter of fact basis by comparing the financial ability of Columbia with that of other Missouri cities, and by comparing the tax levy necessary to finance the proposed program with that of other municipalities of the State. The group of cities used in making these comparisons is shown in Table XXII. The population and relative population rank of each city for the last three census periods are shown. According to the 1920 census these cities ranged in population from 5,200 in the case of Mexico up to 77,939 for St. Joseph. In studying this table

TABLE XXII.  
POPULATION BY DECADES OF 25 MISSOURI CITIES USED IN MAKING FINANCIAL  
COMPARISON.

City	1920		1910		1900	
	Population	Rank	Population	Rank	Population	Rank
St. Joseph.....	77,939	1	77,403	1	102,979	1
Springfield.....	39,631	2	35,201	2	23,267	3
Joplin.....	29,902	3	32,073	3	26,023	2
Sedalia.....	21,144	4	17,822	5	15,231	4
Hannibal.....	19,306	5	18,341	4	12,780	5
Jefferson City.....	14,490	6	11,850	6	9,664	6
Moberly.....	12,808	7	10,923	8	8,012	9
Independence.....	11,686	8	9,859	9	6,974	13
<b>COLUMBIA</b> .....	10,392	9	9,662	10	5,651	16
Cape Girardeau.....	10,252	10	8,475	13	4,815	22
Carthage.....	10,068	11	9,483	11	9,416	7
Webster Groves.....	9,474	12	7,080	15	7,895	11
St. Charles.....	8,503	13	9,437	12	7,982	10
Poplar Bluff.....	8,042	14	6,916	16	4,321	23
Webb City.....	7,807	15	11,817	7	9,201	8
Maplewood.....	7,431	16	4,967	23	-----	--
Kirksville.....	7,213	17	6,347	17	5,966	15
Nevada.....	7,139	18	7,176	14	7,461	12
Trenton.....	6,951	19	5,656	21	5,396	18
University City.....	6,792	20	2,417	25	-----	--
Chillicothe.....	6,772	21	6,265	18	6,905	14
Brookfield.....	6,304	22	5,749	20	5,484	17
Mexico.....	6,013	24	5,939	19	5,099	19
Fulton.....	5,595	24	5,228	22	4,883	21
Marshall.....	5,200	25	4,867	24	5,086	20

TABLE XXIII.  
WEALTH OF 25 MISSOURI CITIES, POPULATION FOR 1920, VALUATION FOR 1924.

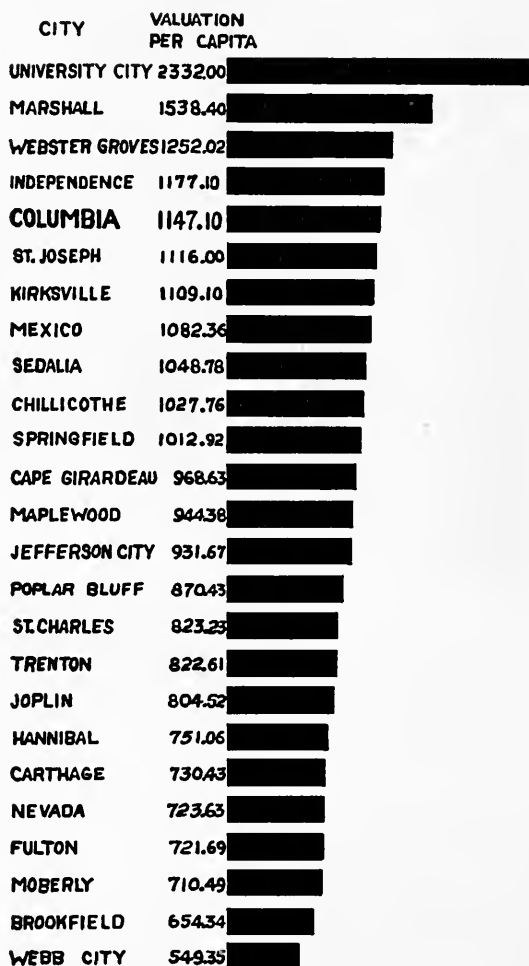
City	Assessed Valuation	Population 1920	Valuation Per Capita	Rank
University City.....	15,839,370	6,792	2,332.00	1
Marshall.....	8,000,000	5,200	1,538.40	2
Webster Groves.....	11,861,650	9,474	1,252.02	3
Independence.....	13,754,526	11,686	1,177.10	4
<b>COLUMBIA</b> .....	11,921,000	10,392	1,147.10	5
St. Joseph.....	87,000,000	77,939	1,116.00	6
Kirksville.....	8,000,000	7,213	1,109.10	7
Mexico.....	6,508,260	6,103	1,082.36	8
Sedalia.....	22,175,433	21,144	1,048.78	9
Chillicothe.....	6,960,000	6,772	1,027.76	10
Springfield.....	40,143,112	39,631	1,012.92	11
Cape Girardeau.....	9,930,400	10,252	968.63	12
Maplewood.....	7,017,740	7,431	944.38	13
Jefferson City.....	13,500,000	14,490	931.67	14
Poplar Bluff.....	7,000,000	8,042	870.43	15
St. Charles.....	7,000,000	8,503	823.23	16
Trenton.....	5,717,949	6,951	822.61	17
Joplin.....	24,056,834	29,902	804.52	18
Hannibal.....	14,500,000	19,306	751.06	19
Carthage.....	7,534,000	10,068	730.43	20
Nevada.....	5,166,000	7,139	723.63	21
Fulton.....	4,037,903	5,595	721.69	22
Moberly.....	9,100,000	12,808	710.49	23
Brookfield.....	4,125,000	6,304	654.34	24
Webb City.....	4,288,819	7,807	549.35	25

one is struck by the fact that while Columbia ranked sixteenth in population among these cities in 1900, her rank in 1920 was ninth. This fact is significant because it shows that on account of her relatively rapid growth Columbia might be expected to find it necessary to spend more than an average city for additional school building facilities.

Columbia ranks high in wealth. If we compare the assessed valuation of these 25 cities we find that Columbia ranks fifth in wealth per

## CHART 4

ASSESSED VALUATION PER INHABITANT IN COLUMBIA  
AND 24 OTHER MISSOURI CITIES



inhabitant. Her assessed valuation per capita, as indicated in Table XXIII, and Chart 4, is more than double that of the lowest ranking city and is 20 per cent above the median of the group.

### Present Indebtedness for School Improvements Not Excessive.

If Columbia were overburdened with indebtedness for school improvements at the present time there might be some ground for hesitating in recommending a school building program of substantial proportions. A study of Table XXIV, however, shows that Columbia does not have a heavy per capita bonded indebtedness in comparison with other cities. She has less than one-fourth of the per capita indebtedness of University City, less than one-third of that of Marshall and in the neighborhood of one-half of that of Chillicothe, Nevada and Trenton.

TABLE XXIV.

## INDEBTEDNESS PER CAPITA OF POPULATION IN 25 MISSOURI CITIES.

For School Year 1923-1924.

City	Total Indebtedness For Sch. Purposes	Population	Per Capita Indebtedness	Rank
University City.....	606,000	6,792	\$89.22	1
Marshall.....	386,500	5,200	74.32	2
Webster Groves.....	541,000	9,474	57.10	3
Chillicothe.....	312,000	6,772	46.07	4
Nevada.....	310,000	7,139	43.42	5
Trenton.....	290,000	6,951	41.72	6
Hannibal.....	692,000	19,306	35.84	7
Maplewood.....	265,000	7,431	35.66	8
Jefferson City.....	497,000	14,490	34.30	9
Sedalia.....	711,000	21,144	33.62	10
St. Charles.....	224,000	8,503	26.34	11
Carthage.....	265,000	10,068	26.32	12
<b>COLUMBIA</b> .....	232,000	10,392	22.32	13
Poplar Bluff.....	173,000	8,042	21.51	14
Cape Girardeau.....	204,000	10,252	19.81	15
Independence.....	192,000	11,686	16.42	16
St. Joseph.....	1,238,000	77,939	15.88	17
Springfield.....	600,000	39,631	15.13	18
Webb City.....	115,000	7,807	14.73	19
Joplin.....	422,000	29,902	14.11	20
Brookfield.....	70,000	6,304	11.10	21
Moberly.....	110,000	12,808	8.58	22
Fulton.....	39,000	5,595	6.97	23
Mexico.....	28,000	6,013	4.65	24
Kirksville.....	30,000	7,213	4.15	25

### Has Columbia Overburdened Herself With Taxation For School Purposes?

The average tax rate over a period of eight years is shown for the previously described group of 25 Missouri Cities in Table XXV and

Chart 5. Columbia ranks twentieth in the average tax rate for school purposes levied during the past eight years. She could finance the proposed building program with a smaller school levy during the next twenty years than such cities as Webster Groves, Maplewood, Brookfield, Webb City, Nevada and Carthage have averaged during the past eight years. She would not need to even remotely approach the 1924-25 levies of \$2.42 on the hundred dollars in Webster Groves, \$2.10 in Maplewood, \$1.90 in Carthage and \$1.80 in Independence.

TABLE XXV.

AVERAGE TAX LEVY FOR PURPOSES OF EDUCATION FOR EIGHT YEARS PER \$100 VALUATION. DATA FOR 1917-24.

City	Average School Tax Per \$100 Valuation	Rank
Webster Groves.....	\$2.10	1
Maplewood.....	1.93	2
Brookfield.....	1.59	3
Webb City.....	1.56	4
Nevada.....	1.49	5
Carthage.....	1.48	6
Cape Girardeau.....	1.46	7
Joplin.....	1.45	8
Chillicothe.....	1.44	9
Hannibal.....	1.40	10
Moberly.....	1.35	11
Trenton.....	1.34	12
Independence.....	1.31	13
Kirksville.....	1.30	14
Poplar Bluff.....	1.28	15
University City.....	1.27	16
Sedalia.....	1.26	17
Springfield.....	1.24	18
St. Joseph.....	1.19	19
<b>COLUMBIA</b> .....	1.19	20
Marshall.....	1.13	21
Fulton.....	1.09	22
Jefferson City.....	1.08	23
Mexico.....	1.05	24
St. Charles.....	.60	25

Of 25 Missouri towns, Columbia ranks twentieth in the average tax rate for school purposes during the past 8 years.



## CHART 5.

AVERAGE LEVY FOR SCHOOL PURPOSES 1917-24 IN  
COLUMBIA AND 24 OTHER MISSOURI CITIES

CITY	AV. SCH. TAX	
WEBSTER GROVES	2.10	
MAPLEWOOD	1.93	
BROOKFIELD	1.59	
WEBB CITY	1.56	
NEVADA	1.49	
CARTHAGE	1.48	
CAPE GIRARDEAU	1.46	
JOPLIN	1.45	
CHILLICOTHE	1.44	
HANNIBAL	1.40	
MOBERLY	1.35	
TRENTON	1.34	
INDEPENDENCE	1.31	
KIRKSVILLE	1.30	
POPLAR BLUFF	1.28	
UNIVERSITY CITY	1.27	
SEDALIA	1.26	
SPRINGFIELD	1.24	
ST. JOSEPH	1.19	
COLUMBIA	1.19	
MARSHALL	1.13	
FULTON	1.09	
JEFFERSON CITY	1.08	
MEXICO	1.05	
ST. CHARLES	.60	

## SUMMARY

1. It is estimated that the assessed valuation of Columbia will increase to at least \$17,500,000 by 1945.

2. With this conservative estimated increase Columbia could finance the building program outlined in Chapter IV without any unusually great increase in the rate of taxation for school purposes.

3. The total tax levy required for interest, sinking fund and serial payments under the plan recommended would probably not exceed 50 cents on the \$100 valuation for any one year up to 1945<sup>1</sup>. Assuming a tax rate of 100 cents for teachers wages and incidentals, the maximum total tax rate for any one year would not exceed \$1.50. This maximum would be only 31 cents higher than Columbia's average annual total tax rate for the past eight years.

4. Columbia ranks high in assessed valuation per inhabitant when compared with other Missouri cities. She has ample wealth to provide school building facilities far above the average.

5. Columbia has maintained her schools during the past eight years on a lower average tax levy than most Missouri cities have found necessary.

(1) Making due allowance for delinquent taxes and minor contingencies.

# APPENDIX A

## ELEMENTARY SCHOOL SCORE CARD

### STRAYER-ENGELHARDT SCORE CARD FOR ELEMENTARY SCHOOL BUILDINGS

#### Score of Building

	1	2	3		1	2	3
<b>I—Site</b> .....			125				
<b>A. Location</b> .....		55				30	
1. Accessibility.....	25				10		
2. Environment.....	30				10		
<b>B. Drainage</b> .....		30					
1. Elevation.....	20						
2. Nature of soil.....	10						
<b>C. Size and Form</b> .....	40	40					
<b>II—Building</b> .....			165				
<b>A. Placement</b> .....		25					
1. Orientation.....	15						
2. Position on site.....	10						
<b>B. Gross Structure</b> .....		60					
1. Type.....	5						
2. Material.....	10						
3. Height.....	5						
4. Roof.....	5						
5. Foundations.....	5						
6. Walls.....	5						
7. Entrances.....	10						
8. Aesthetic balance.....	5						
9. Condition.....	10						
<b>C. Internal Structure</b> .....		80					
1. Stairways.....	35						
2. Corridors.....	20						
3. Basement.....	15						
4. Color Scheme.....	5						
5. Attic.....	5						
<b>III—Service System</b> .....			280				
<b>A. Heating and Ventilation</b> .....		80					
1. Kind.....	15						
2. Installation.....	15						
3. Air supply.....	15						
4. Fans and motors.....	10						
5. Distribution.....	10						
6. Temperature control.....	10						
7. Special provisions.....	5						
<b>B. Fire Protection System</b> .....		65					
1. Apparatus.....	10						
2. Fireproofness.....	15						
3. Escapes.....	20						
4. Electric wiring.....	5						
5. Fire doors and partitions.....	10						
6. Exit lights and signs.....	5						
<b>C. Cleaning System</b> .....		20					
1. Kind.....	5						
2. Installation.....	5						
3. Efficiency.....	10						
<b>D. Artificial Lighting System</b> .....		20					
1. Gas and electricity.....	5						
2. Outlets and adjustment.....	5						
3. Illumination.....	5						
4. Method and fixtures.....	5						
<b>E. Electric Service System</b> .....		15					
1. Clock.....	5						
2. Bells and Gongs.....	5						
3. Telephone.....	5						
<b>F. Water Supply System</b> .....						30	
1. Drinking.....	10						
2. Washing.....	10						
3. Bathing.....	5						
4. Hot and cold.....	5						
<b>G. Toilet System</b> .....						50	
1. Distribution.....	10						
2. Fixtures.....	10						
3. Adequacy and arrangement.....	10						
4. Seclusion.....	5						
5. Sanitation.....	15						
<b>IV—Class Rooms</b> .....							290
<b>A. Location and Connection</b> .....		35				35	
<b>B. Construction and Finish</b> .....						95	
1. Size and number.....	25						
2. Shape.....	15						
3. Floors.....	10						
4. Walls and ceilings.....	10						
5. Doors.....	5						
6. Closets.....	5						
7. Blackboards.....	10						
8. Bulletin boards.....	5						
9. Color scheme.....	10						
<b>C. Illumination</b> .....						85	
1. Glass area.....	45						
2. Windows.....	30						
3. Shades.....	10						
<b>D. Cloakrooms and Wardrobes</b> .....	25					25	
<b>E. Equipment</b> .....						50	
1. Seats and desks.....	35						
2. Teacher's desk.....	10						
3. Other equipment.....	5						
<b>V—Special Rooms</b> .....							140
<b>A. Large Rooms for General Use</b> .....						65	
1. Play room.....	10						
2. Auditorium.....	15						
3. Library.....	10						
4. Gymnasium.....	15						
5. Swimming pool.....	5						
6. Lunch room.....	10						
<b>B. Rooms for School Officials</b> .....						35	
1. Officers.....	10						
2. Teachers' room.....	10						
3. Medical suite.....	10						
4. Janitor's room.....	5						
<b>C. Other Special Service Rooms</b> .....						40	
1. Household arts.....	20						
2. Industrial arts.....	10						
3. General science and Drawing.....	5						
4. Store rooms.....	5						
<b>Totals</b> .....	1000	1000	1000				

Instructions for Using Card—(1) Basis for Scoring, 1000 points. (2) For scoring three columns are allowed. While actually at work on a building only the first need be filled out, the second and third to be filled out at leisure. (3) Where credit is allowed for any single item not present and not needed in a building draw a circle around such credit. All scores should be recorded on the basis of the standards contained in the bulletin: *The Strayer-Engelhardt Standards for Elementary School Buildings*. Bureau of Publication, Teachers College, Columbia University, N. Y.

# APPENDIX B

## HIGH SCHOOL SCORE CARD

	1	2	3
<b>A. Clothing Laboratory</b>	1		
1. Dressmaking laboratory	1		
2. Sewing laboratory	1		
3. Sewing machine	1		
4. Sewing machine	1		
<b>C. Industrial Arts Shop</b>		10	
1. Woodworking shop	1		
2. Print shop	1		
3. Machine shop	1		
4. Auto repair shop	1		
5. Other shop	10		
<b>D. Commercial Laboratory</b>		15	
1. Bookkeeping room	1		
2. Stenography room	1		
3. Typing room	1		
4. Commercial laboratory	1		
5. Other commercial lab	1		
<b>E. Drawing and Art Classroom</b>		15	
1. Freehand drawing	1		
2. Mechanical drawing	1		
3. Art and crafts	1		
4. Other art classes	1		
<b>F. Music Rooms</b>		5	
1. Music room	1		
2. Music room	1		
<b>G. Physical Science</b>		10	
<b>A. Assembly</b>	15		
1. Shop	1		
2. Shop drawing table	1		
3. Physical science	1		
4. Property room	1		
5. Visualization equipment	1		
6. Other science	1		
<b>H. Other</b>		10	
<b>A. Cafeteria</b>	10		
1. Lunch room	1		
2. Faculty lunch room	1		
3. Kitchen	1		
4. Club reading room	1		
5. Assembly room	1		

	1	2	3
<b>C. Construction Facilities</b>		10	
1. Construction room	1		
2. Construction gallery	1		
3. Office	1		
4. Construction room	1		
5. Other auxiliary room	1		
<b>D. Stenography Room</b>	10	10	
<b>E. Library</b>		20	
1. Library reading room	10		
2. Library's workroom	2		
3. Library classroom	1		
4. Library study room	1		
<b>F. Study Hall</b>	10	10	
<b>G. Administrative Offices</b>		10	
1. Principal's office	1		
2. Assistant principal's office	1		
3. General office	1		
4. Reception and waiting room	1		
5. Study room	1		
6. Other	1		
<b>H. Teachers' Rooms</b>		10	
1. Teacher's room	1		
2. Men's waiting room	1		
3. Teacher's reception room	1		
<b>I. Health Service Rooms</b>		10	
1. Health room	1		
2. Nurse's room	1		
3. Health clinic	1		
4. Health room	1		
5. Health clinic	1		
6. Health room	1		
<b>J. Student Activity Rooms</b>		1	
1. Student's office	1		
2. Student's office	1		
3. Student's office	1		
4. Student's office	1		
5. Student's office	1		
6. Student's office	1		
7. Student's office	1		
8. Student's office	1		
9. Student's office	1		
10. Student's office	1		
<b>K. Other</b>		100	100

High School Buildings Score Card

1000

### SCORE CARD FOR HIGH SCHOOL BUILDINGS

BY  
GEORGE D. STRAYER

AND

N. L. ENGELHARDT

TEACHERS COLLEGE COLUMBIA UNIVERSITY.

Published by  
Bureau of Publications, Teachers College, Columbia University  
New York City

Name of School \_\_\_\_\_ Date \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Score \_\_\_\_\_

Interpretation of Table (Caption)—(1) Room for scoring, 1000 points. (2) For scoring, these columns are divided. When a building is not a building only the first part of the table, the second and third to be filled out at once. (3) When credit is allowed for any single item not present and not needed in a building, give a credit amount such as 10. All items should be recorded on the basis of the maximum available in the column. "Handbook for High School Buildings" by G. D. Strayer and N. L. Engelhardt. Published by Bureau of Publications, Teachers College, Columbia University, New York City.

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#### Strayer-Engelhardt Score Card for High School Buildings

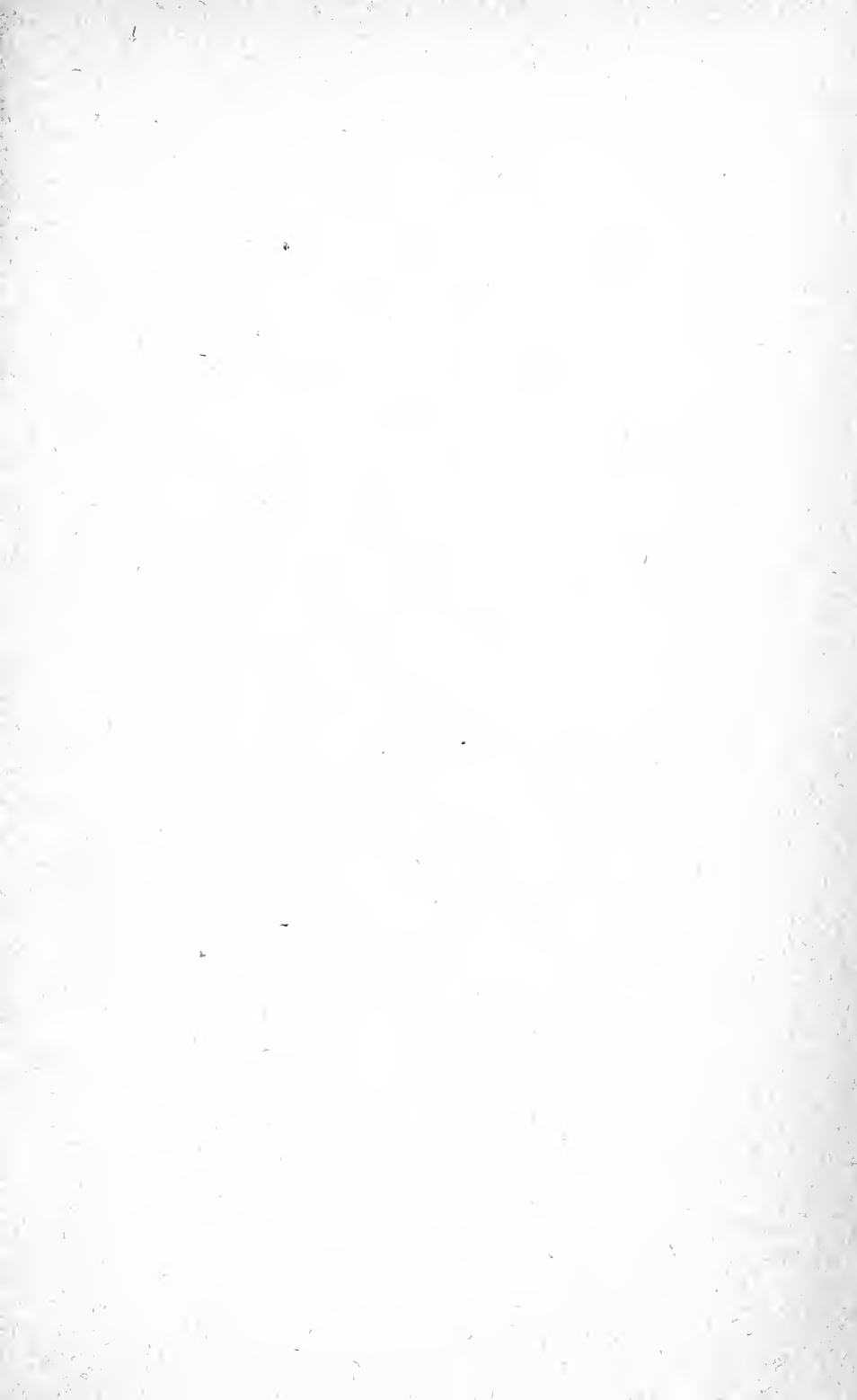
	1	2	3
<b>A. City</b>		10	10
1. Location	1		
2. Accessibility	1		
3. Surroundings	1		
4. Views and conditions	1		
5. Location of site	1		
<b>B. General Score</b>	10	10	10
<b>C. Planning</b>		10	
1. Planning	1		
2. Planning in use	1		
<b>D. Construction</b>		15	
1. Type	1		
2. Material	1		
3. Height	1		
4. Wall	1		
5. Foundation	1		
6. Walls	1		
7. Roofs	1		
8. Utilities	1		
9. Structural details	1		
<b>E. Costing</b>		10	
1. Materials	1		
2. Labor	1		
3. Other items	1		
4. Summary	1		
<b>F. Other</b>		10	
<b>G. Other</b>		10	
1. Room	1		
2. Location	1		
3. Material	1		
4. Height	1		
5. Wall	1		
6. Foundation	1		
7. Walls	1		
8. Roofs	1		
9. Utilities	1		
10. Structural details	1		

	1	2	3
<b>A. Fire Protection System</b>		10	
1. Apparatus	1		
2. Fireproofing	1		
3. Fire exit	1		
4. Electric wiring	1		
5. Fire doors and partitions	1		
6. Exit lights and signs	1		
<b>B. Heating System</b>		10	
1. Room	1		
2. Heating	1		
3. Gas and electricity	1		
<b>C. Artificial Lighting System</b>		10	
1. Gas and electricity	1		
2. Outlets and switches	1		
3. Methods and fixtures	1		
<b>D. Mechanical System</b>		10	
1. Climate	1		
2. Temperature	1		
3. Fire alarm system	1		
4. Call system	1		
5. Departmental electric service	1		
<b>E. Water Supply System</b>		10	
1. Drinking	1		
2. Washing	1		
3. Bathing	1		
4. Hot and cold water plumbing	1		
<b>F. Other</b>		10	
1. Disinfection	1		
2. Fire alarm	1		
3. Admixture and drainage	1		
4. Sanitation	1		
5. Sanitation	1		
<b>G. Mechanical Service Rooms</b>		1	
1. Location	1		
2. Room	1		
3. Location	1		
4. Material	1		
5. Height	1		
6. Wall	1		
7. Foundation	1		
8. Walls	1		
9. Roofs	1		
10. Utilities	1		
11. Structural details	1		

	1	2	3
<b>A. Accessibility</b>	1		
1. Road access	1		
2. Connected to work shop	1		
3. Access to main	1		
4. Connected to shop	1		
5. School supply storage	1		
6. Storage and display area	1		
<b>B. Construction</b>		10	
1. Type	1		
2. Material	1		
3. Height	1		
4. Wall	1		
5. Foundation	1		
6. Walls	1		
7. Roofs	1		
8. Utilities	1		
9. Structural details	1		
<b>C. Costing</b>		10	
1. Materials	1		
2. Labor	1		
3. Other items	1		
4. Summary	1		
<b>D. Other</b>		10	
1. Room	1		
2. Location	1		
3. Material	1		
4. Height	1		
5. Wall	1		
6. Foundation	1		
7. Walls	1		
8. Roofs	1		
9. Utilities	1		
10. Structural details	1		













BINDING LIST DEC 1 1928



